(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平5－282426

(43)公開日　平成５年(1993)10月29日

(51)Int.Cl.[5]		識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ０６Ｆ	15/62	３５０	8125－5L		
	3/153	３２０　Ｍ	9188－5B		
	15/60	４００　Ａ	7922－5L		
	15/62	３２０　Ｋ	8125－5L		

審査請求　未請求　請求項の数７(全 14 頁)

(21)出願番号　特願平4－80580

(22)出願日　平成４年(1992)４月２日

(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地

(72)発明者　中村　康浩
大阪府門真市大字門真1006番地　松下電器産業株式会社内

(72)発明者　吉村　哲也
大阪府門真市大字門真1006番地　松下電器産業株式会社内

(72)発明者　杉浦　雅貴
大阪府門真市大字門真1006番地　松下電器産業株式会社内

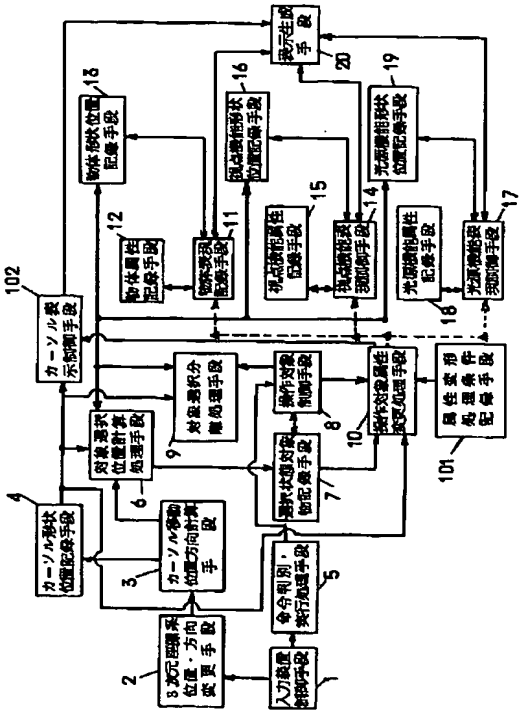
(74)代理人　弁理士　小鍛冶　明　（外２名）

(54)【発明の名称】　視点・光源機能の属性変更直接操作システム

(57)【要約】

【目的】　視点や光源の制御機能を有する３次元情報処理システムに於けるインタフェース方式に関するもので、視点や光源機能を３次元仮想空間で操作者の意図どおりに操作し難いという問題を解決し、操作者による３次元仮想空間中の直接操作と各機能属性の３次元図形視覚化により、これら機能の容易かつ迅速な操作を可能とすることを目的とする。

【構成】　物体、視点機能、光源機能という異なる種類の対象物を、操作対象の切り替え指定なしにいつでも自由に選択・操作するために、対象物の属性を３次元図形として視覚化し、この形状の任意箇所を操作の基準点として空間中で直に指示し移動できようにする２、３、４、６、７、８、９の関係からなる各手段と、視点や光源機能の形状を直に変形することにより、その属性値を変更できるようにする６、７、８、１０、１０１、１０２、１１、１４、１７の関係からなる各手段を設けることにより、操作者は直観的かつ迅速に視点や光源機能等の対象物を空間中で操作できるようにした属性変更直接操作システム。



1

【特許請求の範囲】

【請求項１】　３次元位置方向制御装置やキーボードからの空間情報やボタン情報を入力する入力装置制御手段と、前記入力装置制御手段からのデータを基にシステムで取り扱っている３次元仮想空間座標系の空間位置・方向値に変換する３次元座標系位置・方向変更手段と、前記３次元座標系位置・方向変更手段からのデータを基に３次元カーソルの新しい移動位置を計算し、旧データを更新するカーソル移動位置方向計算手段と、３次元カーソルの形状を記録したり前記カーソル移動位置方向計算手段からのデータを更新記録するカーソル形状位置記録手段と、前記入力装置制御手段との関係により操作者からの対象選択指示や対象選択解除指示等の命令を判別して適切な処理手段を実行する命令判別・実行処理手段と、前記カーソル移動位置方向計算手段からの要求によって前記カーソル形状位置記録手段や対象物の形状位置データの記録してある物体形状位置記録手段や視点機能形状位置記録手段や光源機能形状位置記録手段からのデータを基に、３次元カーソルと各対象物との接触計算を行い３次元カーソルと接触する各対象物識別番号、更にこの対象物形状中の稜線、頂点等の正確な接触部位を示す接触箇所識別番号を抽出し、接触時の３次元カーソルの空間位置データと共に選択状態対象物記録手段へ送る対象選択位置計算処理手段と、前記対象選択位置計算処理手段からのデータを基に３次元カーソルによる対象物の操作状態や選択対象物識別番号、接触箇所識別番号や接触時の３次元カーソルの空間位置データを記録する選択状態対象物記録手段と、前記命令判別・実行処理手段からの対象選択要求または選択解除要求を受けて前記選択状態対象物記録手段からのデータを基に３次元カーソルによる対象物の操作状態を判別し、その結果を前記選択状態対象物記録手段へ記録すると共に、この操作状態に従って接触対象を移動・配置する処理や対象物の属性を変更する処理を制御する操作対象制御手段と、前記操作対象制御手段からの要求により前記カーソル形状位置記録手段や物体形状位置記録手段、視点機能形状位置記録手段、光源機能形状位置記録手段からのデータを基に選択対象物を３次元仮想空間中で移動させたり、３次元カーソルと選択中の対象物を分離・配置する処理を行う対象選択分離処理手段と、前記操作対象制御手段からの要求により前記選択状態対象物記録手段及び前記カーソル形状位置記録手段からのデータを基に前記属性変形処理条件記録手段に記録されている属性変更条件を参照して、対象物の属性を変更するためのデータを作成し、各対象別の属性や形状を実際に変更する物体表現制御手段、視点機能表現制御手段、光源機能表現制御手段のいずれかを起動する操作対象属性変更処理手段と、前記操作対象属性変更処理手段との関係から各対象別にその属性値の変更許容範囲や形状の変更可能な位置・方向等の制約条件等が記録されている属性変形処理条件記録手段

2

と、前記操作対象属性変更処理手段との関係により対象の属性変更時の形状の変形方向・位置によって制約される３次元カーソルの移動や表示を制御するカーソル表示制御手段と、前記操作対象属性変更処理手段との関係により対象となっている物体の形状データを更新し必要に応じて変更された形状の変形内容に従って物体の属性値データを変更したり、物体を描画するために必要なデータを表示生成手段へ転送する物体表現制御手段と、前記物体表現制御手段との関係により各物体の色、材質感等の属性値を更新記録する物体属性記録手段と、前記対象選択位置計算処理手段や前記対象選択分離処理手段や前記物体表現制御手段との関係により物体の形状データや空間位置データを更新記録する物体形状位置記録手段と、前記操作対象属性変更処理手段との関係により視点機能の形状データを更新し必要に応じて変更された形状の変形内容に従って視点機能の属性値を変更したり、視点機能の形状データや属性値等の情報を表示生成手段へ転送する視点機能表現制御手段と、前記視点機能表現制御手段との関係により視野角度や視野領域等の属性値を更新記録する視点機能属性記録手段と、前記対象選択位置計算処理手段や前記対象選択分離処理手段や前記視点機能表現制御手段との関係により視点機能を表現する形状データや空間位置データを更新記録する視点機能形状位置記録手段と、前記操作対象属性変更処理手段との関係により光源機能の形状データを更新し必要に応じて変更された形状の変形内容に従って光源機能の属性値を変更したり、光源機能の形状データや属性値等の情報を表示生成手段へ転送する光源機能表現制御手段と、前記光源機能表現制御手段との関係により光源色や光源強度等の属性値を記録する光源機能属性記録手段と、前記対象選択位置計算処理手段や前記対象選択分離処理手段や前記光源機能表現制御手段との関係により光源機能を表現する形状データや空間位置データを記録する光源機能形状位置記録手段と、前記物体表現制御手段と前記視点機能表現制御手段と前記光源機能表現制御手段と前記カーソル表示制御手段からのデータを基に視点計算・光源計算を行い３次元カーソルを含めた全対象物を表示装置に描画する表示生成手段からなる視点・光源機能の属性変更直接操作システム。

【請求項２】　対象選択分離処理手段がカーソル形状位置記録手段と物体形状・位置記録手段と視点機能形状位置記録手段及び光源機能形状位置記録手段からのデータを基に３次元カーソルで選択した視点機能及び光源機能の任意位置をを基準点として選択対象物の移動及び３次元カーソルと選択中の対象物の分離・配置を行うことを特徴とする請求項１記載の視点・光源機能の属性変更直接操作システム。

【請求項３】　画面中に表示された異なる種類の対象物に対し操作対象制御手段が選択状態対象物記録手段からのデータを基に直接３次元カーソルからの指示に従い選

択・移動処理することを特徴とする請求項１記載の視点・光源機能の属性変更直接操作システム。

【請求項４】　操作対象属性変更処理手段が物体表現制御手段と視点機能表現制御手段と光源機能表現制御手段とカーソル表現制御手段との関係より３次元仮想空間中に存在する対象物の視覚化３次元図形を直接３次元カーソルを用いて変形することによりその属性値を変更することを特徴とする請求項１記載の視点・光源機能の属性変更直接操作システム。

【請求項５】　選択対象物記録手段と前記属性変形処理条件記録手段からのデータを基に対象物の変更可能な属性及びその属性の変更の許容範囲と制約条件を判断し属性形状の変形動作を制約する操作対象属性変更処理手段及びカーソル表現制御手段を設けたことを特徴とする請求項１記載の視点・光源機能の属性変更直接操作システム。

【請求項６】　視点機能の属性である視野領域の種類と位置・方向及び有効範囲を３次元図形で表現することを特徴する請求項１記載の視点・光源機能の属性変更直接操作システム。

【請求項７】　光源機能の属性である色及び種類及び位置・方向と有効範囲をを３次元図形で表現することを特徴する請求項１記載の視点・光源機能の属性変更直接操作システム。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、３次元形状を高速に描画できるコンピュータ・グラフィックス装置を用いた３次元形状の工業意匠、建築、機械等の設計を支援する３次元情報処理システムで使用される視点機能や光源機能を容易かつ効率的に操作するためのインタフェース方式に関するものである。

【０００２】

【従来の技術】従来には図６に示す表示装置６１と２次元入力装置６２（マウス）とキーボード６３を装備した視点や光源の制御機能を有する３次元情報処理システムが存在した。通常、このようなシステムを使用する操作者６４は、はじめに、２次元入力装置６２を操作して、表示装置６１のスクリーン６５上を水平・垂直方向にのみ動かすことができるカーソル６６を操作対象指定メニュー６７上へ移動させ、自分の興味のある操作対象を指定する。操作対象メニューには、物体操作６８、視点操作６９、光源操作６１０があり、指定した対象物だけが、操作可能となる。操作対象が確定すると、各対象別に階層サブメニューが、６１１に現れ、視点や光源属性等の更に詳細な指定を行う。

【０００３】図７は、従来の視点機能の操作画面の一例である。操作者が視点操作メニュー７５を指定すると、表示画面７１中のメイン描画ウィンドウ７２に視点変更機能を示すカメラ等の視点形状７３が表示され、これと

同時に、この形状の存在する位置から見た３次元仮想空間中の景観が別のサブ描画ウィンドウ７４に表示される。操作者は、入力装置を用いてメイン描画ウィンドウ７２中にカーソル７６を移動させ、この形状を３次元仮想空間中で平行・回転移動させることによって、いろいろの位置・方向からの景観をサブ描画ウィンドウ７４に見ることができる。なお、この視点形状の３次元仮想空間中の平行・回転の基準点は、システムにより予め決められている。

【０００４】視点形状の回転・平行移動操作は、キーボード上の特定のキーや２次元入力装置に装備されている特定のボタンを押しながら、２次元入力装置を卓上で前後・左右に移動することによって行われる。このボタンの押下操作と入力装置の移動操作の併用により、視点形状をメイン描画ウィンドウ上で水平・垂直方向に平行移動させたり、水平・垂直方向の軸回りに回転移動させたり、操作者から表示装置に向かって奥行き方向に平行移動させる。操作者は、これらの操作の組合せを考えながら自分の意図する空間位置・方向へ視点形状を動かす。

【０００５】図８は、従来の光源変更機能の操作画面の一例である。光源種には、平行光源、点光源、スポット光源の３種類があり、図８の（ａ）は平行光源形状を、図８の（ｂ）は点光源形状を、図８の（ｃ）はスポット光源形状を示している。これらの光源種は、光源操作の指定後に表示される階層サブメニュー８ａ１１で指定する。各光源の操作は、ほぼ同様であるため、以後、平行光源の場合を中心に述べる。光源操作の指定後に表示される階層サブメニュー８ａ１１で、平行光源の操作を指定すると、図８の（ａ）に示すように、表示画面８ａ１中の描画ウィンドウ８ａ２に、平行光源の方向を示す矢印等の線画の光源形状８ａ３が表示され、これと同時に、平行光源特性に従ったシーンが同一の描画ウィンドウ８ａ２中に描画される。操作者は、入力装置を用いて、描画ウィンドウ中にカーソルを移動させて、平行光源形状８ａ３を３次元仮想空間中で平行・回転移動させることによって、いろいろの方向に平行光源を向けたときの光源シーンを見ることができる。なお、この光源形状の操作の基準点は、視点操作の場合と同様にシステムによって決められている。

【０００６】基本操作は、視点機能と同じなので省略する。図９は、前記した従来システムの構成を示すブロック図である。図中、線と矢印は、データの流れを示す。通常、入力装置制御手段９１は、２次元入力装置やキーボードを制御して、２次元入力装置からのＸ，Ｙの２次元位置データやボタン情報を受け取る。このデータの内、２次元位置データは、画像座標系変換処理手段９２により、表示装置の物理的なスクリーン位置座標値に変換されると同時に、ここでカーソルの新しい移動位置への描画がカーソル描画手段９１６を用いて行われる。このスクリーン位置座標値と入力装置制御手段９１からの

２次元入力装置やキーボードのボタン情報によって、命令判別・実行処理手段９３では、現行の操作者からの指示が、操作対象の切り替え要求か、操作対象の回転・平行移動操作要求か、操作対象の属性変更要求かを判断し、各要求に従って、操作対象切り替え処理手段９４、操作対象制御手段９６、操作対象属性変更処理手段９８のいずれかを起動する。

【０００７】操作対象切り替え処理手段９４に起動が掛かると、命令判別・実行処理手段９４から渡された操作対象物の識別番号を操作対象物記録手段９５に記録する。

【０００８】また、操作対象制御手段９６に起動が掛かると、まず、命令判別・実行処理手段９３から渡された入力装置の２次元位置データを３次元座標系位置・方向計算処理手段９７を用いて、３次元仮想空間中の座標値に変換する。次に、操作対象物記録手段９５から、現行の操作対象物識別番号を読み込んで、その識別番号の示す操作対象物の位置・方向計算処理手段９１１、９９または９１３を起動する。例えば、操作対象物識別番号が、物体を示していた場合には物体移動位置方向計算手段９１１を、視点機能を示していた場合には視点移動位置方向計算手段９９を、光源機能を示していた場合には光源移動位置方向計算手段９１３が起動される。各移動位置方向計算手段では、操作対象物識別番号と３次元座標系位置・方向計算処理手段９７で計算された３次元座標データを基に、各操作対象の新しい空間位置・方向を計算し、物体・視点・光源の各形状・属性記録手段９１２、９１０または９１４の位置・方向データを更新する。表示生成手段９１５では、物体形状・属性記録手段９１２、視野形状・属性記録手段９１０、光源形状・属性記録手段９１３からの形状幾何データや属性データを基に、３次元仮想空間中に存在する全ての対象物を表示装置に描画する。

【０００９】更に、操作対象属性変更処理手段９８に起動が掛かると、まず、操作対象物記録手段９５から、現行の操作対象物識別番号を読み込んで、その識別番号に従った物体・視点・光源の各形状・属性記録手段９１２、９１０または９１４の中の現行の属性値と入力装置制御手段９１から入力され命令判別・実行処理手段９３を経由して入ってきた操作者指定の属性値とを交換する。

【００１０】

【発明が解決しようとする課題】しかしながら、前述した従来の視点・光源機能の空間直接操作システムによる視点や光源機能の操作では、これら機能が３次元仮想空間に及ぼす影響範囲や空間的な位置・方向が視覚的に理解しにくいため、視点や光源機能を表現した形状を操作して希望の画像シーンや光源シーンを得ることが難しかった。また、同一３次元仮想空間中に存在する物体や視点機能や光源機能という対象を操作する場合にもメニュ

一等で対象の切り替えを指定してから行わなくてはならないとか、各対象を空間操作する場合にＸ、Ｙ軸方向の回転や平行移動等の２次元操作の組合せを考えながら行わなくてはならないとか、各対象形状の操作基準点はシステムにより決められており変更できない等の問題により、容易に自分の思った空間位置・方向に物体や視点・光源機能を操作することが難しかった。更に、視野領域の大きさや光源強度等の属性を変更して、自分の意図する視点・光源機能を仕立てようとする場合にも、属性変更結果の予測しにくい数値や記号で属性値を変えて、属性変更後に視点・光源機能を実際に操作してから変更内容が正しいかどうかを判断していたために、操作者のイメージする属性をもつ視点・光源機能を作り出すのに多くの時間を必要とした。

【００１１】本発明は、上記課題に鑑み、視点・光源機能の属性を３次元図形として視覚的に表現し、操作者がこの３次元図形の任意箇所を選択して直接的に空間操作したり、またこの３次元形状を仮想空間中で直に変形することによってその属性値を変更することを可能とし、視点・光源機能の形状の移動操作や変形操作に追従して、各機能効果の変化を即座に描画することにより、操作者の頭の中でイメージする画像シーンや光源シーンを迅速かつ容易に得られるようにするためのインタフェースを提供するものである。

【００１２】

【課題を解決するための手段】上記目的を達成するための本発明の技術的手段は、３次元位置方向制御装置やキーボードからの空間情報やボタン情報を入力する入力装置制御手段と、前記入力装置制御手段からのデータを基にシステムで取り扱っている３次元仮想空間座標系の空間位置・方向値に変換する３次元座標系位置・方向変更手段と、前記３次元座標系位置・方向変更手段からのデータを基に３次元カーソルの新しい移動位置を計算し、旧データを更新するカーソル移動位置方向計算手段と、３次元カーソルの形状を記録したり前記カーソル移動位置方向計算手段からのデータを更新記録するカーソル形状位置記録手段と、前記入力装置制御手段との関係により操作者からの対象選択指示や対象分離指示等の命令を判別して適切な処理手段を実行する命令判別・実行処理手段と、前記カーソル移動位置方向計算手段からの要求によって前記カーソル形状位置記録手段や対象物の形状位置データの記録してある物体形状位置記録手段や視点機能形状位置記録手段や光源機能形状位置記録手段からのデータを基に、３次元カーソルと各対象物との接触計算を行い３次元カーソルと接触する各対象物識別番号や更にこの対象物形状中の稜線、頂点等の正確な接触部位を示す接触箇所識別番号を抽出し、接触時の３次元カーソルの空間位置データと共に選択状態対象物記録手段へ送る対象選択位置計算処理手段と、前記対象選択位置計算処理手段からのデータを基に３次元カーソルによる対

象物の操作状態や選択対象物識別番号、接触箇所識別番号、接触時の３次元カーソルの空間位置データを記録する選択状態対象物記録手段と、前記命令判別・実行処理手段からの対象選択要求または選択解除要求を受けて前記選択状態対象物記録手段からのデータを基に３次元カーソルによる対象物の操作状態を判別し、その結果を前記選択状態対象物記録手段へ記録すると共に、この操作状態に従って接触対象を移動・配置する処理や対象物の属性を変更する処理を制御する操作対象制御手段と、前記操作対象制御手段からの要求により前記カーソル形状位置記録手段や物体形状位置記録手段や視点機能形状位置記録手段や光源機能形状位置記録手段からのデータを基に、選択対象物を３次元仮想空間中で移動させたり、３次元カーソルと選択中の対象物を分離・配置する処理を行う対象選択分離処理手段と、前記操作対象制御手段からの要求により前記選択状態対象物記録手段及び前記カーソル形状位置記録手段からのデータを基に前記属性変形処理条件記録手段に記録されている属性変更条件を参照して、対象物の属性を変更するためのデータを作成し、各対象別の属性や形状を実際に変更する物体表現制御手段や視点機能表現制御手段や光源機能表現制御手段のいずれかを起動する操作対象属性変更処理手段と、前記操作対象属性変更処理手段との関係から各対象別にその属性値の変更許容範囲や形状の変更可能な位置・方向等の制約条件等が記録されている属性変形処理条件記録手段と、前記操作対象属性変更処理手段との関係により対象の属性変更時の形状の変形方向・位置によって制約される３次元カーソルの移動や表示を制御するカーソル表示制御手段と、前記操作対象属性変更処理手段との関係により対象となっている物体の形状データを更新し必要に応じて変更された形状の変形内容に従って物体の属性値データを変更したり、物体を描画するために必要なデータを表示生成手段へ転送する物体表現制御手段と、前記物体表現制御手段との関係により各物体の色、材質感等の属性値を更新記録する物体属性記録手段と、前記対象選択位置計算処理手段や前記対象選択分離処理手段や前記物体表現制御手段との関係により物体の形状データや空間位置データを更新記録する物体形状位置記録手段と、前記操作対象属性変更処理手段との関係により視点機能の形状データを更新し必要に応じて変更された形状の変形内容に従って視点機能の属性値を変更したり、視点機能の形状データや属性値等の情報を表示生成手段へ転送する視点機能表現制御手段と、前記視点機能表現制御手段との関係により視野角度や視野領域等の属性値を更新記録する視点機能属性記録手段と、前記対象選択位置計算処理手段や前記対象選択分離処理手段や前記視点機能表現制御手段との関係により視点機能を表現する形状データや空間位置データを更新記録する視点機能形状位置記録手段と、前記操作対象属性変更処理手段との関係により光源機能の形状データを更新し必要に応じて変更された形状の変形内容に従って光源機能の属性値を変更したり、光源機能の形状データや属性値等の情報を表示生成手段へ転送する光源機能表現制御手段と、前記光源機能表現制御手段との関係により光源色や光源強度等の属性値を記録する光源機能属性記録手段と、前記対象選択位置計算処理手段や前記対象選択分離処理手段や前記光源機能表現制御手段との関係により光源機能を表現する形状データや空間位置データを記録する光源機能形状位置記録手段と、前記物体表現制御手段と前記視点機能表現制御手段と前記光源機能表現制御手段と前記カーソル表示制御手段からのデータを基に視点計算・光源計算を行い３次元カーソルを含めた全対象物を表示装置に描画する表示生成手段からなる視点・光源機能の属性変更直接操作システムを構成したことである。

【００１３】

【作用】上記の手段を有した本発明に於いては、操作者は３次元位置方向入力装置やキーボード等の入力装置を操作することにより３次元カーソルを移動するために必要な３次元位置・方向データや、３次元カーソルで対象物を選択移動したり、分離・配置する指示を入力する。入力装置制御手段は、操作者の入力した３次元位置・方向データや種々の指示情報を入力装置から読み取り、３次元位置・方向データを３次元座標系位置・方向変更手段へ、指示情報を命令判別・実行処理手段へ渡す。

【００１４】３次元座標系位置・方向変更手段では、３次元位置方向入力装置からの３次元位置・方向データを本実施例のシステムで取り扱っている論理的な３次元仮想空間座標値に変換する。カーソル移動位置方向計算手段では、３次元座標系位置・方向変更手段で変換された位置・方向データを基に、新しい３次元カーソルの空間位置を計算すると共に、カーソル形状位置記録手段に記録されている３次元カーソルの位置データを更新する。この後に、カーソル移動位置方向計算手段は、対象選択位置計算処理手段を起動する。対象選択位置計算処理手段では、カーソル形状位置記録手段から３次元カーソルの現行の空間位置データを、各対象物の形状位置記録手段から３次元仮想空間中の全対象物の形状位置データを読み込んで、３次元カーソルと全対象物との接触計算を行う。この計算の結果、接触の有無、接触対象物識別番号、更に正確な３次元カーソルと対象との接触箇所を示した接触対象箇所識別番号及び接触時の３次元カーソルの空間位置データを選択状態対象物記録手段へ記録する。この接触時の３次元カーソル位置データは、対象物の形状を変形させてその属性を変更する際にカーソルの移動量から変形量を計算するときに使用する。

【００１５】操作対象制御手段では、命令判別・実行処理手段からの３次元カーソルと対象物との選択指示や選択解除指示を受けると選択状態対象物記録手段からの情報を基に、接触対象物の有無の判断や３次元カーソルによる対象物の操作状態の判断を行い、この情報を選択状

態対象物記録手段に記録する。更に、この情報を基に、対象物を移動・配置する処理を行う対象選択分離処理手段へ対象物識別番号と共に選択要求または選択解除要求を発行したり、対象物の属性をその形状から変更する処理を行う操作対象属性変更処理手段を起動する。

【００１６】対象選択分離処理手段では、操作対象制御手段から出力される要求及び指定対象物識別番号データに従い、３次元カーソルと指定対象物の位置関係を保持した指定対象物の移動を行なったり３次元カーソルと指定対象物とを分離・配置させるために、カーソル形状位置記録手段から３次元カーソルの位置データを、各形状位置記録手段の中から指定された対象物の形状位置データを読み込んで、３次元幾何計算を行った後に指定対象物の形状位置データを更新する。

【００１７】操作対象属性変更処理手段では、操作対象制御手段からの属性変更要求により起動され、選択対象物記録手段に記録されている接触対象物識別番号及び接触箇所識別番号や接触時の３次元カーソル空間位置データ、更に属性変形処理方法記録手段に記録されている属性変更の許容範囲や制約条件を基に、各対象物の属性値を視覚化した形状を変形させるための変形移動量・方向を計算し、各表現処理手段を起動して対象物の属性形状を変更させる。これと同時に、計算して求めた変形移動量・方向データをカーソル表示制御手段に送り、属性変更時の３次元カーソルの動きや表示を制御させる。この計算によって求められる属性形状の変形移動量・方向は、選択状態対象物記録手段に記録されている対象接触時の３次元カーソル位置データと属性変更操作指定確定後にカーソル形状位置記録手段から読み込んだ３次元カーソルの位置データとの差分による相対量を基本として、属性変更の許容範囲や制約条件データから求められる。

【００１８】物体表現制御手段では、操作対象表現属性変更処理手段からの要求により、物体形状位置記録手段中の物体形状データを更新し、この形状変更内容に従って物体属性記録手段中の指定物体の属性値を更新する。また、表示生成手段からの要求によって、各物体を表示するために必要な形状データや位置データ及び属性データを物体形状・位置記録手段や物体形状・位置記録手段から読み込んで表示生成手段へ渡す。

【００１９】視点機能表現制御手段では、操作対象表現属性変更処理手段からの要求により、視点機能形状位置記録手段中の視点機能の形状データを更新し、この形状の更新内容に従って視点機能属性記録手段中の属性値を更新する。また、表示生成手段からの要求によって、視点機能形状の表示及び視点計算処理を行うために必要な視点機能属性記録手段からの視点機能属性データ及び視点機能形状位置記録手段からの形状位置データを表示生成手段へ渡す。

【００２０】光源機能表現制御手段では、操作対象表現属性変更処理手段からの要求により、光源機能形状位置記録手段中の光源機能の形状データを更新し、この形状の更新内容に従って光源機能属性記録手段中の指定光源種の属性を更新する。また、表示生成手段からの要求によって、光源機能形状の表示及び光源計算処理を行うために必要な光源機能属性記録手段からの光源機能属性データ及び光源機能形状位置記録手段からの形状位置データを表示生成手段へ渡す。

【００２１】表示生成手段では、カーソル表現制御手段と物体表現制御手段と視点機能表現制御手段と光源機能表現制御手段からの各種データを基に視点計算、光源計算処理を行い、３次元カーソルを含めた全ての対象物を表示装置に描画する。

【００２２】

【実施例】以下、本発明の実施例について、図面を参照しながら説明する。図１は本発明の実施例の構成を示すブロック図、図２は本発明の実施例に於ける構成装置例と代表的な表示画面例、図３は本発明の実施例に於ける詳細な操作画面例、図４及び図５は本発明の実施例に於ける視点機能、光源機能の属性値の変更操作画面例を示す。

【００２３】図２（ａ）では、操作者２７が３次元位置方向制御装置２３の３次元位置方向入力装置２１を手に持って移動させ、本実施例に於けるシステムに対して動作指示を行っているところを示している。表示装置２６中の代表的な表示画面が図２（ｂ）の２ａに示してある。３次元原点指定部２２と３次元位置方向入力装置２１の実空間での位置と方向の関係から３次元位置方向制御装置２３で３次元位置・方向を計測し、グラフィックスコンピュータ２５が、このデータをコンピュータ内で取り扱っている論理的な３次元仮想空間座標系での位置・方向データに変換して、表示装置２６の画面２ａ中の３次元カーソル２ａ１を３次元位置方向入力装置２１の動きに追従して移動させる。操作者の操作を希望する３次元仮想空間中の物体２ａ２、２ａ３や視点機能の空間位置を視覚化した視点位置形状２ａ４または光源機能の種類と空間位置を視覚化した光源種位置形状２ａ５などの対象物のいずれかを３次元カーソル２ａ１の先端で触れ、キーボード２４等から選択指示を出すとその対象物が選択され、３次元カーソルと共に３次元位置方向入力装置２１の動きに追従して仮想空間中を動く。

【００２４】画面２ａ中に示す視点機能は、視点位置形状２ａ４とこの形状の前方位置に固定された視点機能の有効範囲を示す半透明の視点領域形状２ａ８により表現されている。また、同画面２ａ中に示す光源機能は、光源種位置形状２ａ５とこの形状の前方位置に固定された光源機能の有効範囲を示す半透明円錐形の光源領域形状２ａ９により表現されている。これらの各形状は、視野角度、視界深度、光源種、光源強度等の視点や光源機能の属性値により色や形状が変化する。

11

【００２５】画面２ａ中の視点位置形状２ａ４や光源種位置形状２ａ５を選択すると、視点領域形状２ａ８や光源領域形状２ａ９も、視点位置形状２ａ４や光源種位置形状２ａ５との接続位置関係を保持して３次元仮想空間内で動き、これら形状の空間的な位置関係にマッチした各機能の効果が画面２ａ中の各ウィンドウにリアルタイムに表示される。

【００２６】視点位置形状２ａ４を動かした場合は、視点領域形状２ａ８内の景観があたかも視点位置形状２ａ４から操作者が見ているかのごとくサブ描画ウィンドウ２ａ６中に表示され、光源種位置形状２ａ５を動かした場合は、光源領域形状２ａ９内の対象物にその光源特性が加味された景観が、メイン描画ウィンドウ２ａ７とサブ描画ウィンドウ２ａ６に直接表示される。同一３次元仮想空間中に存在する物体２ａ２、２ａ３や視点位置形状２ａ４や光源種位置形状２ａ５は、メニュー等による操作対象の切り替え指示無しに、３次元カーソル２ａ１によりいつでも選択でき、空間中での移動・回転操作という同一の方法で制御することが可能である。

【００２７】図３では、視点機能及び光源機能を操作しているときの本実施例に於ける画面表示と３次元位置入力装置の関係を示している。図３（ａ）は、３次元位置方向入力装置３０を操作して、仮想空間中の３次元カーソル３１を動かして、視点位置形状３２を選択し、物体３６、３７、３８の内、物体３６と３７のみを見ようとするために、視点位置形状３２を移動させて３（ａ）の画面に示す位置・方向に視点領域形状３３を配置したところである。図３（ｂ）は、視点機能を３（ａ）の画面中で示した位置・方向で固定させ、次に光源機能を操作するために、まず視点位置形状３２と３次元カーソル３１との分離指示を出した後に、３次元位置方向入力装置３０を矢印３ｂ１のように操作して３次元カーソル３１を３（ｂ）の画面の位置に動かし、光源種位置形状３４を選択したところを示している。図３（ｃ）は、３次元位置方向入力装置３０を矢印３ｃ１のように移動操作して、スポット光源が物体３８の表示画面に向かって後方から手前に照射するように光源種位置形状３４を移動したところである。この時、光源種位置形状３４及び光源領域形状３５の仮想空間内での空間的な位置・方向に従ったスポット光源機能の効果がメイン描画ウィンドウ３１０と視点位置形状から見た景観を表示しているサブ描画ウィンドウ３１１に表示される。再び、視点機能を操作したい場合には、光源種位置形状３４と３次元カーソル３１の接続を分離指定して、視点位置形状３２の希望の箇所を選択指示すればよい。

【００２８】図４及び図５を用いて、機能属性の変更操作について述べる。図４では、視点機能の属性値を表現した形状を画面中で直接変形させることによって、その値を変更する場合の操作例を示している。４（ａ）の画面中、３次元カーソル４１で視点領域形状４２の四面体

12

の底面（ファー平面）４２ｆｐの頂点４２ｆｐｖを選択し、矢印４ａ１の示すように斜め上方向へ引き上げると、４（ｂ）の画面に示すように、ファー平面が、そのアスペクト比を保持して大きくなる。この視点領域形状の変形に対応して、視点機能の属性値が自動的に変更され、この形状内の景観を表示したサブ描画ウィンドウ４１１中の景観も変形に追従して４（ｂ）の画面に示すように表示される。４（ｃ）では、更にファー平面４２ｆｐの稜線４２ｆｐｅを３次元カーソル４１で選択し矢印４ｃ１に示すように横方向に引っ張った状態を示しており、この場合は、視点領域のアスペクト比が変わりサブ描画ウィンドウ４１１がワイド表示となる。このように、操作者により選択指示された形状の部位によって、変更されるべき属性がシステムにより判断され、変更可能なその属性の許容条件に従って、変形内容が決定、処理される。

【００２９】図５では、光源機能の属性値を表現した形状を画面中で直接変形させることによって、その値を変更する場合の操作例を示している。５（ａ）の５ａ１と５ａ２は平行光源の属性を変更している時の操作例、５（ｂ）の５ｂ１と５ｂ２は点光源の属性を変更している時の操作例、５（ｃ）の５ｃ１と５ｃ２はスポット光源の属性を変更している時の操作例である。平行光源の場合は、画面５ａ１で示すように平行光の方向を示した形状５２を３次元カーソル５１で選択し、矢印５ａ１ａで示す方向へ引っ張ると、画面５ａ２中の５２のように形状が伸び、この形状の変形と同期して、画面中の平行光の強度も変化する。画面５ａ２は、平行光源の強度の増加により、光の照射されない暗部が薄く小さくなっている状態を示している。点光源の場合は、画面５ｂ１で示すように点光源の有効範囲を示す球形状５３の表面を３次元カーソル５１で選択し、矢印５ｂ１ａで示す方向へ移動させると、画面５ｂ２中の５３のように球の半径が小さくなり、この形状変形に追従して、画面中の点光源の強度が低下し、５３に示すように点光源の照射される領域が小さくなる。スポット光源の場合も、点光源の場合と同様な例が画面５ｃ１と５ｃ２に示してある。

【００３０】次に、図１を参照しながら本実施例の構成と動作を説明する。図１において、各ブロックは処理手段を示し、線と矢印はデータや信号の流れを示す。まず、構成について述べる。図中、１は３次元位置方向制御装置やキーボードからの空間情報やボタン情報を入力する入力装置制御手段、２は３次元位置方向制御装置からのデータを基にシステムで取り扱っている３次元仮想空間座標系の空間位置・方向値に変換する３次元座標系位置・方向変更手段、３は３次元座標系位置・方向変更手段２からのデータを基に３次元カーソルの新しい移動位置を計算し、旧データを更新するカーソル移動位置方向計算手段、４は３次元カーソルの形状を記録したり、カーソル移動位置方向計算手段からのデータを更新記録

するカーソル形状位置記録手段、５は入力装置制御手段との関係により操作者からの対象選択指示や対象選択解除指示等の命令を判別して適切な処理手段を実行する命令判別・実行処理手段、６はカーソル移動位置方向計算手段３からの要求によってカーソル形状位置記録手段４や各対象形状の位置データの記録してある各対象物の形状位置記録手段１３、１６、１９からのデータを基に、３次元カーソルと各対象物との接触計算を行い、３次元カーソルと接触する各対象物識別番号、更にこの対象物形状中の稜線、頂点等の正確な接触部位を示す接触箇所識別番号を抽出し、接触時の３次元カーソルの空間位置データと共に選択状態対象物記録手段へ送る対象選択位置計算処理手段、７は対象選択位置計算処理手段６からのデータを基に３次元カーソルによる対象物の操作状態や選択対象物識別番号や接触箇所識別番号や接触時の３次元カーソルの空間位置データを記録する選択状態対象物記録手段、８は命令判別・実行処理手段５からの対象選択要求または対象選択解除要求を受けて選択状態対象物記録手段７からのデータを基に３次元カーソルによる対象物の操作状態を判別し、その結果を選択状態対象物記録手段７へ記録すると共に、この操作状態に従って接触対象を移動・配置する処理や対象物の属性を変更する処理を制御する操作対象制御手段、９は操作対象制御手段８からの要求によりカーソル形状位置記録手段４や各対象物の形状位置記録手段１３、１６、１９からのデータを基に、選択対象物を３次元仮想空間中で移動させたり、３次元カーソルと選択中の対象物を分離・配置する処理を行う対象選択分離処理手段、１０は操作対象制御手段からの要求により選択状態対象物記録手段７及びカーソル形状位置記録手段４からのデータを基に属性変形処理条件記録手段１０１に記録されている属性変更条件を参照して、対象物の属性を変更するためのデータを作成し、各対象別の属性や形状を実際に変更する表現制御手段１１、１４、１７を起動する操作対象属性変更処理手段、１０１は操作対象属性変更処理手段１０との関係から各対象別にその属性の変更許容範囲や形状の変更可能な位置・方向等の制約条件等が記録されている属性変形処理条件記録手段、１０２は操作対象属性変更処理手段１０との関係により対象の属性変更時の形状の変形方向・位置によって制約される３次元カーソルの移動や表示を制御するカーソル表示制御手段、１１は操作対象属性変更処理手段１０との関係により対象となっている物体の形状データを更新し必要に応じて変更された形状の変形内容に従って物体の属性値データを変更したり、物体を描画するために必要なデータを表示生成手段２０へ転送する物体表現制御手段、１２は物体表現制御手段１１との関係により各物体の色、材質感等の属性値を更新記録する物体属性記録手段、１３は対象選択位置計算処理手段６や対象選択分離処理手段９や物体表現制御手段１１との関係により物体の形状データや空間位置データ

を更新記録する物体形状位置記録手段、１４は操作対象属性変更処理手段１０との関係により視点機能の形状データを更新し必要に応じて変更された形状の変形内容に従って視点機能の属性値を変更したり、視点機能の形状データや属性値等の情報を表示生成手段２０へ転送する視点機能表現制御手段、１５は視点機能表現制御手段１４との関係により視野角度や視野領域等の属性値を更新記録する視点機能属性記録手段、１６は対象選択位置計算処理手段６や対象選択分離処理手段９や視点機能表現制御手段１４との関係により視点機能を表現する形状データや空間位置データを更新記録する視点機能形状位置記録手段、１７は操作対象属性変更処理手段１０との関係により光源機能の形状データを更新し必要に応じて変更された形状の変形内容に従って光源機能の属性値を変更したり、光源機能の形状データや属性値等の情報を表示生成手段２０へ転送する光源機能表現制御手段、１８は光源機能表現制御手段１７との関係により光源色や光源強度等の属性値を記録する光源機能属性記録手段、１９は対象選択位置計算処理手段６や対象選択分離処理手段９や光源機能表現制御手段１７との関係により光源機能を表現する形状データや空間位置データを記録する光源機能形状位置記録手段、２０は物体表現制御手段８と視点機能表現制御手段１２と光源機能表現制御手段１６とカーソル表示制御手段４からのデータを基に視点計算・光源計算を行い３次元カーソルを含めた全対象物を表示装置に描画する表示生成手段である。次に、各構成間の動作について述べる。操作者は３次元位置方向入力装置やキーボード等の入力装置を操作することにより３次元カーソルを移動するために必要な３次元位置・方向データや、３次元カーソルで対象物を選択移動したり、分離・配置する指示を入力する。入力装置制御手段１は、操作者の入力した３次元位置・方向データや種々の指示情報を入力装置から読み取り、３次元位置・方向データを３次元座標系位置・方向変更手段２へ、指示情報を命令判別・実行処理手段５へ渡す。

【００３１】３次元座標系位置・方向変更手段２では、３次元位置方向入力装置からの３次元位置・方向データを本実施例のシステムで取り扱っている論理的な３次元仮想空間座標値に変換する。カーソル移動位置方向計算手段３では、３次元座標系位置・方向変更手段２で変換された位置・方向データを基に、新しい３次元カーソルの空間位置を計算すると共に、カーソル形状位置記録手段４に記録されている３次元カーソルの位置データを更新する。この後に、カーソル移動位置方向計算手段３は、対象選択位置計算処理手段６を起動する。対象選択位置計算処理手段６では、カーソル形状位置記録手段４から３次元カーソルの現行の空間位置データを、各対象物の形状位置記録手段１３、１６、１９から３次元仮想空間中の全対象物の形状位置データを読み込んで、３次元カーソルと全対象物との接触計算を行う。この計算の

結果、接触の有無、接触対象物識別番号、更に正確な３次元カーソルと対象との接触箇所を示した接触対象箇所識別番号及び接触時の３次元カーソルの空間位置データを選択状態対象物記録手段７へ記録する。この接触時の３次元カーソル位置データは、対象物の形状を変形させてその属性を変更する際にカーソルの移動量から変形量を計算するときに使用する。

【００３２】操作対象制御手段８では、命令判別・実行処理手段５からの３次元カーソルと対象物との選択指示や選択解除指示を受けると選択状態対象物記録手段７からの情報を基に、接触対象物の有無の判断や３次元カーソルによる対象物の操作状態の判断を行い、この情報を選択状態対象物記録手段７に記録する。更に、この情報を基に、対象物を移動・配置する処理を行う対象選択分離処理手段９へ対象物識別番号と共に選択要求または選択解除要求を発行したり、対象物の属性をその形状から変更する処理を行う操作対象属性変更処理手段１０を起動する。

【００３３】対象選択分離処理手段９では、操作対象制御手段８から出力される要求及び指定対象物識別番号データに従い、３次元カーソルと指定対象物の位置関係を保持した指定対象物の移動を行なったり、３次元カーソルと指定対象物とを分離・配置させるために、カーソル形状位置記録手段４から３次元カーソルの位置データを、各形状位置記録手段１３、１６または１９の中から指定された対象物の形状位置データを読み込んで、３次元幾何計算を行った後に指定対象物の形状位置データを更新する。

【００３４】操作対象属性変更処理手段１０では、操作対象制御手段８からの属性変更要求により起動され、選択対象物記録手段７に記録されている接触対象物識別番号及び接触箇所識別番号や接触時の３次元カーソル空間位置データ、更に属性変形処理方法記録手段１０１に記録されている属性変更の許容範囲や制約条件を基に、各対象物の属性値を視覚化した形状を変形させるための変形移動量・方向を計算し、各表現処理手段１１、１４、１７を起動して対象物の属性形状を変更させる。これと同時に、計算して求めた変形移動量・方向データをカーソル表示制御手段１０２に送り、属性変更時の３次元カーソルの動きや表示を制御させる。この計算によって求められる属性形状の変形移動量・方向は、選択状態対象物記録手段７に記録されている対象接触時の３次元カーソル位置データと属性変更操作指定確定後にカーソル形状位置記録手段４から読み込んだ３次元カーソルの位置データとの差分による相対量を基本として、属性変更の許容範囲や制約条件データにから求められる。

【００３５】物体表現制御手段１１では、操作対象表現属性変更処理手段１０からの要求により、物体形状位置記録手段１３中の物体形状データを更新し、この形状変更内容に従って物体属性記録手段１２中の指定物体の属性値を更新する。また、表示生成手段２０からの要求によって、各物体を表示するために必要な形状データや位置データ及び属性データを物体形状・位置記録手段１３や物体形状・位置記録手段１２から読み込んで表示生成手段２０へ渡す。

【００３６】視点機能表現制御手段１４では、操作対象表現属性変更処理手段１０からの要求により、視点機能形状位置記録手段１６中の視点機能の形状データを更新し、この形状の更新内容に従って視点機能属性記録手段１５中の属性値を更新する。また、表示生成手段２０からの要求によって、視点機能形状の表示及び視点計算処理を行うために必要な視点機能属性記録手段１５からの視点機能属性データ及び視点機能形状位置記録手段１６からの形状位置データを表示生成手段２０へ渡す。

【００３７】光源機能表現制御手段１７では、操作対象表現属性変更処理手段１０からの要求により、光源機能形状位置記録手段１３中の光源機能の形状データを更新し、この形状の更新内容に従って光源機能属性記録手段１８中の指定光源種の属性を更新する。また、表示生成手段２０からの要求によって、光源機能形状の表示及び光源計算処理を行うために必要な光源機能属性記録手段１８からの光源機能属性データ及び光源機能形状位置記録手段１９からの形状位置データを表示生成手段２０へ渡す。

【００３８】表示生成手段２０では、カーソル表現制御手段１０２と物体表現制御手段１１と視点機能表現制御手段１４と光源機能表現制御手段１７からの各種データを基に視点計算、光源計算処理を行い、３次元カーソルを含めた全ての対象物を表示装置に描画する。

【００３９】以上本実施例によれば視点・光源機能の空間直接操作システムで視点機能や光源機能の属性を操作者に視覚的に３次元形状で提示できると共に、物体の操作と同様に視点や光源機能の形状の任意箇所を仮想空間内で直接、選択し移動するという簡単かつ一慣した操作で、しかも操作対象の切り替え指定無しにいつでも任意の対象物を選択することができる。また、視点機能形状や光源機能形状の空間操作に対応した各機能効果もリアルタイムに表示することが可能となる。更に、メニュー等から数値や記号を入力するのではなく、視点機能や光源機能の属性を視覚化した形状を３次元仮想空間内で直接的に変形することによって、その属性値を変更することができる。これらの機能により、従来の視点機能や光源機能の操作をサポートした３次元情報処理システムに比べると、操作者は３次元仮想空間中での視点機能や光源機能の属性内容、及び機能と対象物との間の空間的位置関係を直観的に把握できるようになり、自分の意図する位置・方向へ各機能を容易かつ迅速に操作できるようになる。また、操作者は、属性変更結果を予測しにくい数値や記号で属性値を変更すること無しに、属性の視覚化した形状を直に変形することによって、視覚的に属性

値を変更できるために、直観的かつ容易な機能の属性変更が可能となる。

【００４０】

【発明の効果】以上の説明から明らかなように本発明によれば３次元情報処理システムで視点機能や光源機能の操作に必要な属性を３次元形状として操作者に視覚的に表現でき、その形状の任意箇所を３次元仮想空間内で直接的に選択・移動できる。また、この操作に追従してインターラクティブに各操作機能の効果が表示されるために、３次元仮想空間中で、視点機能や光源機能の属性や対象物とこれら機能との間の空間的位置関係を直観的に把握できるようになり、操作者は日常的に実世界でビデオ等の視覚装置やランプ等の照明装置を操作するように、視点機能や光源機能を自分の意図する位置・方向へ容易かつ迅速に操作できるようになる。

【００４１】更に、視点機能や光源機能の属性変更に際しても、操作者は属性変更結果を予測しにくい数値や記号で入力しなくても、直に属性を視覚化した形状を変形することができ、属性変更による効果も即座に目で確かめられるために、操作者の意図どおりにの機能を直観的かつ容易に作り出すことができる。

【００４２】これにより、操作者は、頭の中のイメージする画像シーンや光源シーンを容易に得られるようになる。

【図面の簡単な説明】

【図１】本発明の一実施例における視点・光源機能の属性変更直接操作システムの構成を示すブロック図

【図２】本発明の一実施例におけるシステムの装置構成例と表示画面例

【図３】本発明の一実施例における操作画面例

【図４】本発明の一実施例における視点機能の視覚化形状の操作画面例

【図５】本発明の一実施例における光源機能の視覚化形状の操作画面例

【図６】従来の実施例における装置構成例と表示画面例

【図７】従来の実施例における視点機能の操作画面例

【図８】従来の実施例における光源機能の操作画面例

【図９】従来の実施例のシステム構成を示すブロック図

【符号の説明】

１　入力装置制御手段
２　３次元座標系位置・方向変更手段
３　カーソル移動位置方向計算手段
４　カーソル形状位置記録手段
５　命令判別・実行処理手段
６　対象選択位置計算処理手段
７　選択状態対象物記録手段
８　操作対象制御手段
９　対象選択分離処理手段
１０　操作対象属性変更処理手段
１０１　属性変形処理条件記録手段

１０２　カーソル表示制御手段
１１　物体表現制御手段
１２　物体属性記録手段
１３　物体形状位置記録手段
１４　視点機能表現制御手段
１５　視点機能属性記録手段
１６　視点機能形状位置記録手段
１７　光源機能表現制御手段
１８　光源機能属性記録手段
１９　光源機能形状位置記録手段
２０　表示生成手段
２１　３次元位置方向入力装置
２２　３次元原点指定部
２３　３次元位置方向制御装置
２４　キーボード
２５　グラフィックス・コンピュータ
２６　高解像度グラフィックス表示装置
２ａ　表示画面例
２ａ１　３次元カーソル
２ａ２　立方体
２ａ３　四面体
２ａ４　視点位置形状
２ａ５　光源種位置形状
２ａ６　サブ描画ウィンドウ
２ａ７　メイン描画ウィンドウ
２ａ８　視点領域形状
２ａ９　光源領域形状
３ａ　操作画面例
３ｂ　操作画面例
３ｂ１　軌跡
３ｃ　操作画面例
３ｃ１　軌跡
３０　３次元位置方向入力装置
３１　３次元カーソル
３２　視点位置形状
３３　視点領域形状
３４　光源種位置形状
３５　光源領域形状
３６　立方体
３７　四面体
３８　３角柱体
３１０　メイン描画ウィンドウ
３１１　サブ描画ウィンドウ
４ａ１　３次元カーソル操作方向
４ｃ１　３次元カーソル操作方向
４２ｆｐ　ファー平面
４２ｆｐｖ　ファー平面の頂点
４２ｆｐｅ　ファー平面の稜線
４１　３次元カーソル
４３　視野領域属性形状

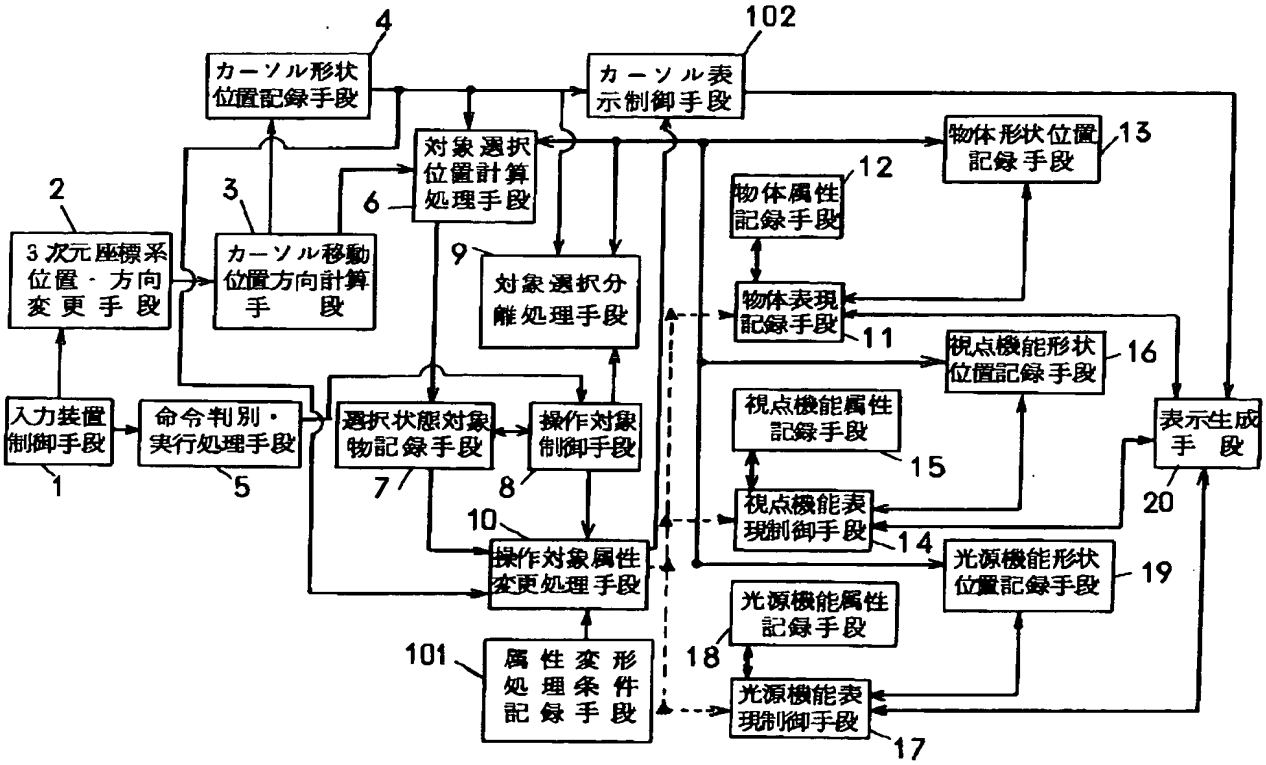
19

４１０　メイン描画ウィンドウ
４１１　サブ描画ウィンドウ
５ａ１　操作画面例
５ａ１ａ　属性形状変形方向
５ａ２　操作画面例
５ｂ１　操作画面例
５ｂ１ａ　属性形状変形方向
５１　３次元カーソル
６２　２次元入力装置
６３　キーボード
６４　操作者
６５　表示スクリーン
６６　２次元カーソル
６７　メニュー領域
６８　物体操作指示メニュー
６９　視点操作指示メニュー
６１０　光源操作指示メニュー例
６１１　階層メニュー領域
７１　表示画面
７２　メイン描画ウィンドウ
７３　視点機能を表現した形状
７４　サブ描画ウィンドウ
７５　メニュー項目例
８ａ　操作画面

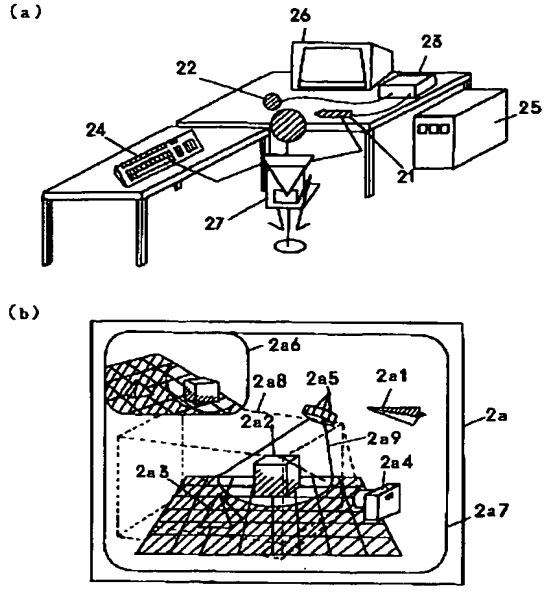
20

＊８ａ１　表示スクリーン
８ａ２　描画ウィンドウ
８ａ３　平行光源を表現した形状
８ａ１１　階層メニュー領域
８ｂ　操作画面
８ｂ１　点光源を表現した形状
８ｃ　スポット光源機能の操作画面
８ｃ１　スポット光源を表現した形状
９１　入力装置制御手段
９２　画面座標系変換処理手段
９３　命令判別・実行処理手段
９４　操作対象切り替え処理手段
９５　操作対象物記録手段
９６　操作対象制御手段
９７　３次元座標系位置・方向計算処理手段
９８　操作対象属性変更処理手段
９９　視点移動位置方向計算手段
９１０　視点形状・属性記録手段
９１１　物体移動位置方向計算手段
９１２　物体形状・属性記録手段
９１３　光源移動位置方向計算手段
９１４　光源形状・属性記録手段
９１５　表示生成手段
＊　９１６　カーソル描画手段

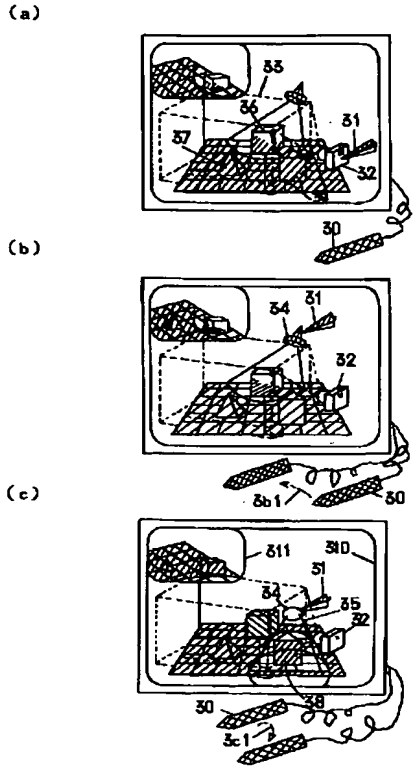
【図１】



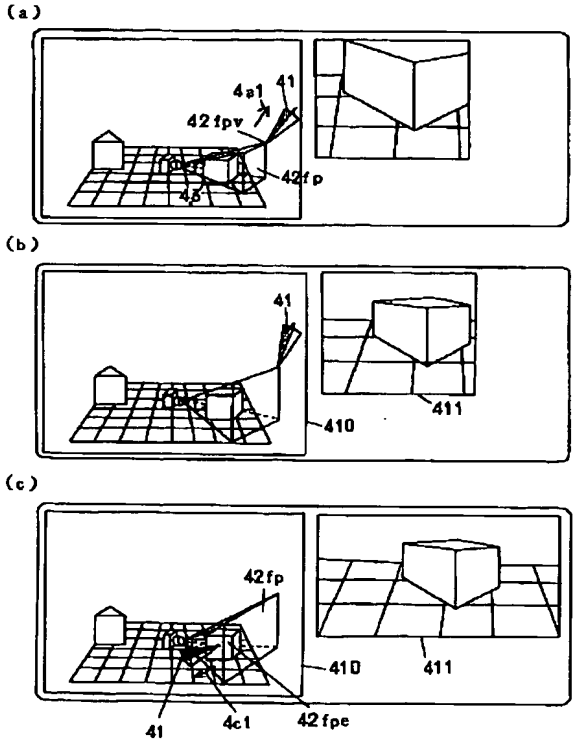
【図２】


(a)
26
23
22
25
24
21
27
(b)
2a6
2a8
2a5
2a1
2a2
2a
2a9
2a4
2a3
2a7

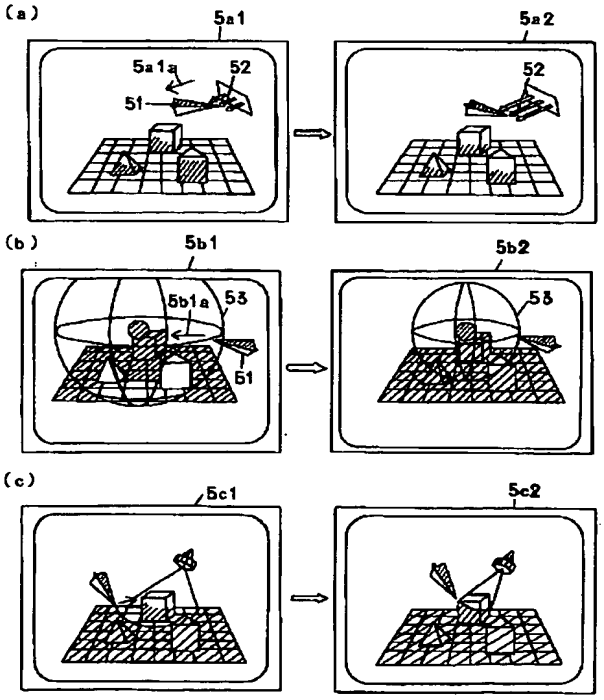
【図３】


(a)
33
36
31
37
32
30
(b)
34
31
32
30
3b1
(c)
311
310
31
34
35
32
30
38
3c1

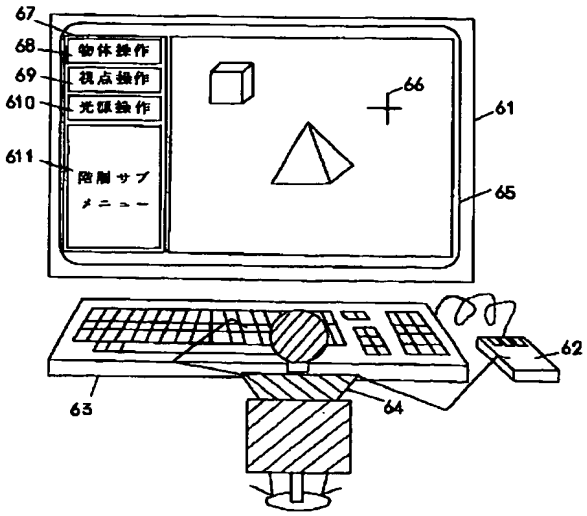
【図４】


(a)
4a1
41
421fpv
42fp
(b)
41
410
411
(c)
42fp
410
411
41
4c1
42fpe

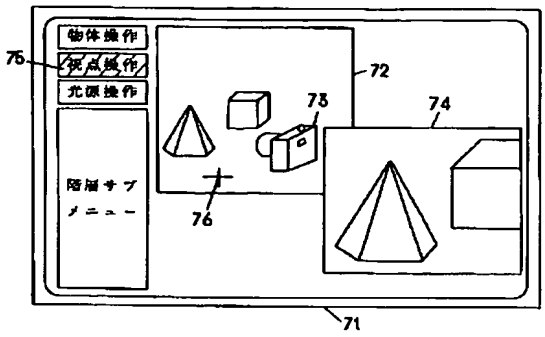
【図５】


(a)
5a1
5a2
5a1a
52
51
52
(b)
5b1
5b2
5b1a
53
51
53
(c)
5c1
5c2

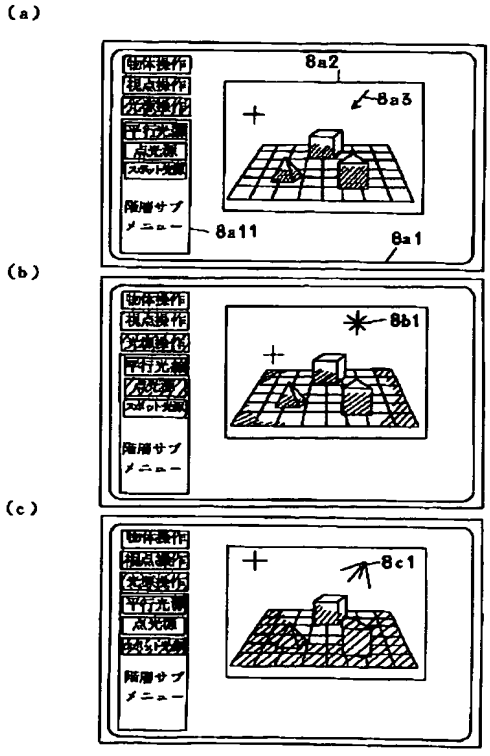
【図６】


67
68
69
610
611
物体操作
視点操作
光源操作
階層サブメニュー
66
61
65
62
63
64

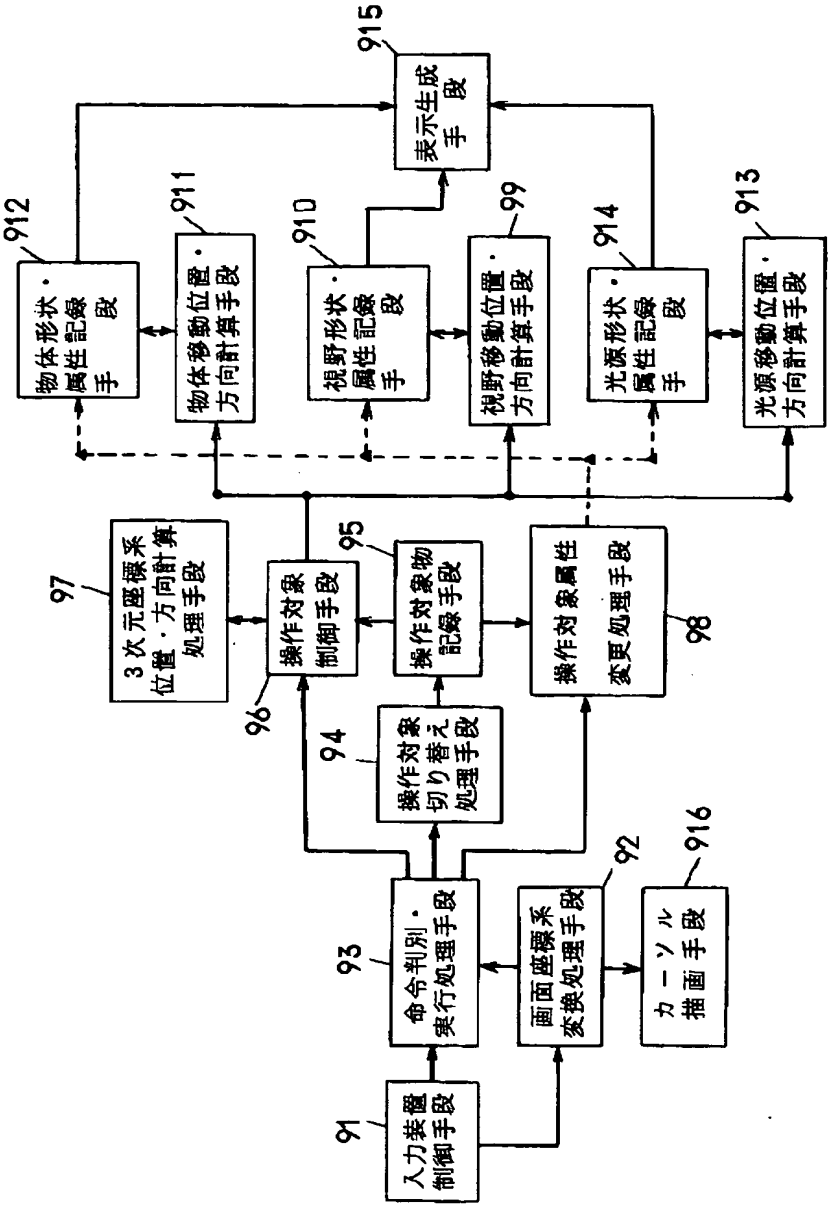
【図７】


物体操作
視点操作
光源操作
階層サブメニュー
75
72
73
74
76
71

【図８】


(a)
(b)
(c)
物体操作
視点操作
光源操作
階層サブメニュー
8a2
8a3
8a11
8a1
8b1
8c1

【図９】


915
表示生成手段
912
物体形状・属性記録手段
911
物体移動位置・方向計算手段
910
視野形状・属性記録手段
99
視野移動位置・方向計算手段
914
光源形状・属性記録手段
913
光源移動位置・方向計算手段
97
3次元座標系位置・方向計算処理手段
96
操作対象制御手段
95
操作対象物記録手段
98
操作対象属性変更処理手段
94
操作対象切り替え処理手段
93
命令判別・実行処理手段
92
画面座標系変換処理手段
916
カーソル描画手段
91
入力装置制御手段

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-282426

(43)Date of publication of application : 29.10.1993

(51)Int.Cl. G06F 15/62
G06F 3/153
G06F 15/60
G06F 15/62

(21)Application number : 04-080580

(22)Date of filing : 02.04.1992

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

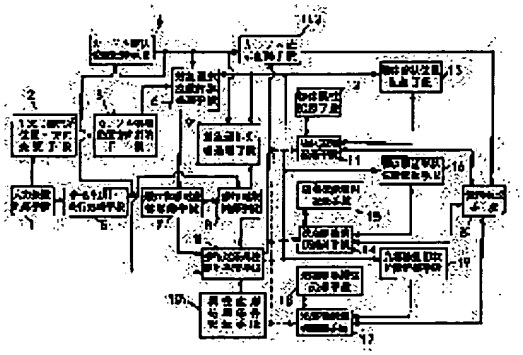
(72)Inventor : NAKAMURA YASUHIRO
YOSHIMURA TETSUYA
SUGIURA MASAKI

(54) DIRECT ATTRIBUTE CHANGE OPERATING SYSTEM FOR VIEWPOINT AND LIGHT SOURCE FUNCTION

(57)Abstract:

PURPOSE: To easily perform a quick operation for viewpoint and light source functions by visualizing a direct operation in three-dimensional space by an operator and the attribute of the viewpoint and light source functions as three dimensional graphics.

CONSTITUTION: This system is comprised in such a way that the operator can operate the object such as the viewpoint function and the light source function, etc., in space intuitively and at high speed by providing means 2, 3, 4, 6, 7, 8, and 9 with relation shown in figure capable of visualizing the attribute of the object as the three-dimensional graphic to freely select and operate different kinds of objects such as a material body, the viewpoint function, the light source function anytime without designating the switching of an operation object. and directly instructing and traveling an arbitrary part of such shape in the space as a reference point, and means 6, 7, 8, 10, 101, 102, 11, 14, and 17 with relation shown in figure capable of changing the attribute values of the view point and light source functions by immediately changing the shape of them.



LEGAL STATUS

[Date of request for examination]	10.12.1993
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	2558988
[Date of registration]	05.09.1996
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	05.09.1999

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The input unit control means which inputs the space information and carbon button information from the three-dimension location direction control device or a keyboard, The three-dimension system-of-coordinates location and a direction modification means to change into the spatial position and direction value of the three-dimension virtual space system of coordinates currently dealt with by the system based on the data from said input-device control means, A cursor advance location direction count means to calculate the new migration location of three-dimension cursor based on the data from said three-dimension system-of-coordinates location and direction modification means, and to update the old data, The cursor configuration location record means which records the configuration of three-dimension cursor or carries out updating record of the data from said cursor advance location direction count means, Instruction distinction and an executive operation means to distinguish the instruction of the object-choice directions from an operator, object-choice discharge directions, etc. with relation with said input unit control means, and to perform a suitable processing means, Based on the data from the body configuration location record means and the view functional configuration location record means which the configuration location data of said cursor configuration location record means and object are recorded by the demand from said cursor advance location direction count means, or a light source functional configuration location record means The number according to each set elephant well informed person which performs contact count with three-dimension cursor and each object, and contacts three-dimension cursor, Furthermore, the object selected position computation means which extracts the contact part identification number which shows exact contact parts, such as a ridgeline in this object configuration, and top-most vertices, and is sent to a selection condition object record means with the spatial position data of the three-dimension cursor at the time of contact, A selection condition object record means to record the spatial position data of the actuation condition of an object with three-dimension cursor, a selection object identification number and a contact part identification number, or the three-dimension cursor at the time of contact based on the data from said object selected position computation means, In response to the object-choice demand from said instruction distinction and executive operation means, or a selection discharge demand, the actuation condition of an object with three-dimension cursor is distinguished based on the data from said selection condition object record means. The control means for actuation which controls the processing which follows this actuation condition, and moves and arranges the candidate for contact while recording that result on said selection condition object record means, and the processing which changes the attribute of an object, By the demand from said control means for actuation, said cursor configuration location record means and a body configuration location record means, An object preferential segregation processing means to perform processing which is made to move a selection object all over a three-dimension virtual space based on the data from a view functional configuration location record means and a light source functional configuration location record means, or separates and arranges the object under three-dimension cursor and selection, The attribute changing condition currently recorded on said attribute deformation processing condition record means by the demand from said control means for actuation

based on the data from said selection condition object record means and said cursor configuration location record means is referred to. An attribute modification processing means for actuation to start the body expression control means which creates the data for changing the attribute of an object and actually changes the attribute and configuration according to each set elephant, a view function table present control means, or a light source function table present control means, An attribute deformation processing condition record means by which the constraint of the modification tolerance of the attribute value, the location, a direction which can change a configuration, etc., etc. is recorded according to each set elephant from relation with said attribute modification processing means for actuation, A cursor display-control means to control migration and a display of the three-dimension cursor restrained by the deformation direction and location of the configuration at the time of the target attribute modification with relation with said attribute modification processing means for actuation, The contents of deformation of the configuration which updated the configuration data of the target body with relation with said attribute modification processing means for actuation, and was changed if needed are followed. Change objective attribute value data or The body expression control means which transmits data required in order to draw a body to a display generation means, The body attribute record means which carries out updating record of the attribute value, such as a color of each body, and a feeling of the quality of the material, with relation with said body expression control means, The body configuration location record means which carries out updating record of objective configuration data and spatial position data with the relation between said object selected position computation means, said object preferential segregation processing means, or said body expression control means, The contents of deformation of the configuration which updated the configuration data of a view function with relation with said attribute modification processing means for actuation, and was changed if needed are followed. Change the attribute value of a view function or The view function table present control means which transmits information, such as configuration data of a view function, and attribute value, to a display generation means, The view functional attribute record means which carries out updating record of the attribute value of whenever [angle-of-visibility], a visual field field, etc. with relation with said view function table present control means, The view functional configuration location record means which carries out updating record of the configuration data which express a view function with the relation between said object selected position computation means, said object preferential segregation processing means, or said view function table present control means, or the spatial position data, The contents of deformation of the configuration which updated the configuration data of a light source function with relation with said attribute modification processing means for actuation, and was changed if needed are followed. Change the attribute value of a light source function, or The light source function table present control means which transmits information, such as configuration data of a light source function, and attribute value, to a display generation means, A light source functional attribute record means to record attribute value, such as the self-luminous color and light source reinforcement, with relation with said light source function table present control means, A light source functional configuration location record means to record the configuration data which express a light source function with the relation between said object selected position computation means, said object preferential segregation processing means, or said light source function table present control means, and spatial position data, Said body expression control means The attribute modification direct-control system of the view and light source function which consists of a display generation means to draw to a display all the objects that performed view count and light source count based on the data from said view function table present control means, said light source function table present control means, and said cursor display-control means, and include three-dimension cursor.

[Claim 2] The attribute modification direct control system of the view and the light source function according to claim 1 which characterize by to perform separation and arrangement of the object under migration of a selection object , and three dimension cursor and selection by make into a reference point arbitration ****** of the view function which an object preferential segregation processing means chose with three dimension cursor based on the data from a cursor configuration location record means , a body configuration and a location record means , a view functional configuration location record

means , and a light source functional configuration location record means , and a light source function .
[Claim 3] the attribute modification direct control system of the view and light source function according to claim 1 characterize by the control means for actuation carry out selection / migration processing according to the directions from direct three dimension cursor to the object of a different class displayed all over the screen based on the data from a selection condition object record means .
[Claim 4] The attribute modification direct-control system of the view and light source function according to claim 1 characterized by changing the attribute value when the attribute modification processing means for actuation transforms the visualization 3-D graphic of the object which exists all over a three-dimension virtual space using direct three-dimension cursor from the relation between a body expression control means, a view function table present control means, a light source function table present control means, and a cursor expression control means.
[Claim 5] The attribute modification direct control system of the view and the light source function according to claim 1 characterize by to establish the attribute modification processing means for actuation and the cursor expression control means which judge the attribute which can change an object , and the tolerance and the constraint of modification of the attribute based on the data from a selection object record means and said attribute deformation processing condition record means , and restrain deformation actuation of an attribute configuration .
[Claim 6] The attribute modification direct-control system of the view and light source function according to claim 1 which carries out the description of expressing the class, the location and the direction, and scope of a visual field field which are the attribute of a view function by the 3-D graphic.
[Claim 7] The attribute modification direct-control system of the view and light source function according to claim 1 which carries out the description of expressing the color, class and the location and the direction which are the attribute of a light source function, and ********** by the 3-D graphic.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the interface method for operating easily and efficiently the view function and light source function which are used with the three-dimension information processing system which supports the design of the industrial design of a three-dimension configuration using the computer graphics equipment which can draw a three-dimension configuration at a high speed, construction, a machine, etc.
[0002]
[Description of the Prior Art] The three-dimension information processing system which has the control function of the view which equipped the indicating equipment 61 and the two-dimensional input device 62 (mouse) which are shown in drawing 6 , and the keyboard 63, or the light source existed in the former. Usually, first, the operator 64 who uses such a system operates the two-dimensional input unit 62, moves the cursor 66 which can move the screen 65 top of a display 61 only to level and a perpendicular direction to up to the assignment menu 67 for actuation, and specifies his interested candidate for actuation. The menu for actuation has the body actuation 68, the view actuation 69, and the light source actuation 610, and only the specified object becomes operational. If the candidate for actuation is decided, a hierarchy sub menu will appear in 611 and will perform still more detailed assignment of a view, a light source attribute, etc. according to each set elephant.
[0003] Drawing 7 is an example of the actuation screen of the conventional view function. If an operator specifies the view actuation menu 75, the view configurations 73, such as a camera in which a view modification function is shown, will be displayed on the Maine drawing window 72 in the display screen 71, and the scene in the three-dimension virtual space seen from the location where it can come, simultaneously this configuration exists will be displayed on another sub drawing window 74. An operator can see the scene from various location and directions in the sub drawing window 74 by moving cursor 76 all over the Maine drawing window 72 using an input unit, and rotating [it is / this configuration / parallel and] it all over a three-dimension virtual space. In addition, the reference point of the parallel and rotation in the three-dimension virtual space of this view configuration is beforehand decided by the system.
[0004] Rotation and parallel translation actuation of a view configuration are performed by moving a two-dimensional input device to order and right and left on a desk, pushing the specific carbon button with which the specific key and specific two-dimensional input device on a keyboard are equipped. Make level and a perpendicular direction carry out a parallel displacement, it is made to rotate to the circumference of the shaft of level and a perpendicular direction, or the parallel displacement of the view configuration is made to carry out [according to concomitant use of depression actuation of this carbon button and migration actuation of an input unit] in the depth direction toward a display from an operator on a Maine drawing window. An operator moves a view configuration in the spatial position and the direction which he means, considering the combination of these actuation.
[0005] Drawing 8 is an example of the actuation screen of the conventional light source modification

function. There are three kinds, the parallel light source, the point light source, and the spot light source, in (a) of drawing 8 , (b) of drawing 8 shows a point light source configuration, and (c) of drawing 8 shows the spot light source configuration to the light source kind for the parallel light source configuration. These light source kinds are specified with the hierarchy sub menu eight a11 displayed after assignment of light source actuation. Since it is almost the same, actuation of each light source is henceforth described focusing on the case of the parallel light source. With the hierarchy sub menu eight a11 displayed after assignment of light source actuation, if actuation of the parallel light source is specified, as shown in (a) of drawing 8 The light source configuration eight a3 of line drawings, such as an arrow head which shows the direction of the parallel light source, is displayed on the drawing window eight a2 in the display screen eight a1, and the scene which could come, simultaneously followed the parallel light source property is drawn all over the same drawing window eight a2. An operator can see the light source scene when turning the parallel light source in the various directions by moving cursor all over a drawing window and rotating [it is / the parallel light source configuration eight a3 / parallel, and] it all over a three-dimension virtual space, using an input unit. In addition, the reference point of actuation of this light source configuration is decided by the system like the case of view actuation.

[0006] Since it is the same as a view function, basic operation is omitted. Drawing 9 is the block diagram showing the structure of a system conventionally [above mentioned]. A line and an arrow head show data flow among drawing. Usually, the input-device control means 91 controls a two-dimensional input device and a keyboard, and receives X from a two-dimensional input device, and two-dimensional location data and carbon button information on Y. Among this data, drawing to the new migration location of cursor is performed here using the cursor drawing means 916 at the same time two-dimensional location data are changed into the physical screen position-coordinate value of a display by the image system-of-coordinates transform-processing means 92. The change demand for actuation, the rotation and the parallel displacement actuation demand for actuation, and the attribute change request for actuation judge, and the directions from the present operator start according to each demand with instruction distinction and an executive-operation means 93 in the change processing means 94 for actuation, the control means 96 for actuation, or the attribute modification processing means 98 for actuation by this screen position-coordinate value and the carbon button information on the two-dimensional input device from the input-device control means 91, or a keyboard.

[0007] If starting starts the change processing means 94 for actuation, the identification number of the actuation object passed from instruction distinction and the executive operation means 94 will be recorded on the actuation object record means 95.

[0008] Moreover, if starting starts the control means 96 for actuation, the two-dimensional location data of the input device passed from instruction distinction and the executive operation means 93 will be first changed into the coordinate value in a three-dimension virtual space using a three-dimension system-of-coordinates location and the direction computation means 97. Next, from the actuation object record means 95, the present actuation object identification number is read and the location and the direction computation means 911, 99, or 913 of the actuation object which the identification number shows are started. For example, in the view migration location direction count means 99, when the actuation object identification number shows the body and it shows the view function for the body migration location direction count means 911, when the light source function is shown, the light source migration location direction count means 913 is started. With each migration location direction count means, based on the three-dimension coordinate data calculated with the actuation object identification number, and a three-dimension system-of-coordinates location and a direction computation means 97, new spatial position and direction for [each] actuation are calculated, and the location and direction data of each configuration and attribute record means 912, 910, or 914 of a body, a view, and the light source are updated. With the display generation means 915, all the objects that exist all over a three-dimension virtual space are drawn to a display based on configuration geometry data and attribute data from a body configuration and the attribute record means 912, a visual field configuration and an attribute record means 910, and a light source configuration and an attribute record means 913.

[0009] Furthermore, if starting starts the attribute modification processing means 98 for actuation, the attribute value specified by [which read the present actuation object identification number, was inputted by the actuation object record means 95 from the present attribute value and the present input unit control means 91 in each configuration and attribute record means 912, 910, or 914 of a body, a view, and the light source that the identification number was followed, and entered via instruction distinction and the executive-operation means 93 from it first] an operator will exchange.
[0010]
[Problem(s) to be Solved by the Invention] However, since it was hard to understand the area of influence, and spatial spatial location and direction which these functions exert on a three-dimension virtual space visually in actuation of the view by the space direct-control system of conventional view and light source function mentioned above, or a light source function, it was difficult to operate the configuration expressing a view or a light source function, and to obtain the image scene and the light source scene of hope. Moreover, in if it must carry out after specifying the target change with a menu etc., also when operating an object called the body and view function which exist all over the same three-dimension virtual space, and a light source function According to if it must carry out considering the combination of two-dimensional actuation, such as rotation of X and Y shaft orientations, and a parallel displacement, when carrying out space actuation of each set elephant, the problem of the actuation reference point of each set elephant configuration being decided by the system, and being unable to change it It was difficult for the spatial position and the direction which he regarded as easy to operate a body, and a view and a light source function. Furthermore, also when it is going to make the view and light source function which changes attributes, such as visual field area size and light source reinforcement, and he means Since the contents of modification had judged whether it was the right after changing attribute value with the numeric value and notation which an attribute modification result cannot predict easily and actually operating the view and the light source function after attribute modification, much time amount was needed for making a view and a light source function with the attribute which an operator imagines.
[0011] This invention expresses the attribute of a view and a light source function visually as a 3-D graphic in view of the above-mentioned technical problem. An operator chooses the arbitration part of this 3-D graphic. Carry out space actuation directly or Moreover, by making it possible to change that attribute value by deforming this three-dimension configuration soon all over a virtual space, following migration actuation and deformation actuation of the configuration of a view and a light source function, and drawing change of each functional effect immediately The interface for obtaining quickly and easily the image scene and light source scene which are imagined in an operator's head is offered.
[0012]
[Means for Solving the Problem] The technical means of this invention for attaining the above-mentioned purpose The input unit control means which inputs the space information and carbon button information from the three-dimension location direction control device or a keyboard, The three-dimension system-of-coordinates location and a direction modification means to change into the spatial position and direction value of the three-dimension virtual space system of coordinates currently dealt with by the system based on the data from said input-device control means, A cursor advance location direction count means to calculate the new migration location of three-dimension cursor based on the data from said three-dimension system-of-coordinates location and direction modification means, and to update the old data, The cursor configuration location record means which records the configuration of three-dimension cursor or carries out updating record of the data from said cursor advance location direction count means, Instruction distinction and an executive operation means to distinguish the instruction of the object-choice directions from an operator, object separation directions, etc. with relation with said input unit control means, and to perform a suitable processing means, Based on the data from the body configuration location record means and the view functional configuration location record means which the configuration location data of said cursor configuration location record means and object are recorded by the demand from said cursor advance location direction count means, or a light source functional configuration location record means the number according to each set elephant

well informed person which performs contact count with three-dimension cursor and each object, and contacts three-dimension cursor -- further -- the ridgeline in this object configuration -- The object selected position computation means which extracts the contact part identification number which shows exact contact parts, such as top-most vertices, and is sent to a selection condition object record means with the spatial position data of the three-dimension cursor at the time of contact, A selection condition object record means to record the spatial position data of the actuation condition of an object with three-dimension cursor, a selection object identification number, a contact part identification number, and the three-dimension cursor at the time of contact based on the data from said object selected position computation means, In response to the object-choice demand from said instruction distinction and executive operation means, or a selection discharge demand, the actuation condition of an object with three-dimension cursor is distinguished based on the data from said selection condition object record means. The control means for actuation which controls the processing which follows this actuation condition, and moves and arranges the candidate for contact while recording that result on said selection condition object record means, and the processing which changes the attribute of an object, By the demand from said control means for actuation, based on the data from said cursor configuration location record means, a body configuration location record means, a view functional configuration location record means, or a light source functional configuration location record means An object preferential segregation processing means to perform processing which is made to move a selection object all over a three-dimension virtual space, or separates and arranges the object under three-dimension cursor and selection, The attribute changing condition currently recorded on said attribute deformation processing condition record means by the demand from said control means for actuation based on the data from said selection condition object record means and said cursor configuration location record means is referred to. An attribute modification processing means for actuation to start the body expression control means and view function table present control means which create the data for changing the attribute of an object and actually change the attribute and configuration according to each set elephant, or a light source function table present control means, An attribute deformation processing condition record means by which the constraint of the modification tolerance of the attribute value, the location, a direction which can change a configuration, etc., etc. is recorded according to each set elephant from relation with said attribute modification processing means for actuation, A cursor display-control means to control migration and a display of the three-dimension cursor restrained by the deformation direction and location of the configuration at the time of the target attribute modification with relation with said attribute modification processing means for actuation, The contents of deformation of the configuration which updated the configuration data of the target body with relation with said attribute modification processing means for actuation, and was changed if needed are followed. Change objective attribute value data or The body expression control means which transmits data required in order to draw a body to a display generation means, The body attribute record means which carries out updating record of the attribute value, such as a color of each body, and a feeling of the quality of the material, with relation with said body expression control means, The body configuration location record means which carries out updating record of objective configuration data and spatial position data with the relation between said object selected position computation means, said object preferential segregation processing means, or said body expression control means, The contents of deformation of the configuration which updated the configuration data of a view function with relation with said attribute modification processing means for actuation, and was changed if needed are followed. Change the attribute value of a view function or The view function table present control means which transmits information, such as configuration data of a view function, and attribute value, to a display generation means, The view functional attribute record means which carries out updating record of the attribute value of whenever [angle-of-visibility], a visual field field, etc. with relation with said view function table present control means, The view functional configuration location record means which carries out updating record of the configuration data which express a view function with the relation between said object selected position computation means, said object preferential segregation processing means, or said view function table present control means, or the spatial position data, The contents of deformation of the configuration which updated the

configuration data of a light source function with relation with said attribute modification processing means for actuation, and was changed if needed are followed. Change the attribute value of a light source function, or The light source function table present control means which transmits information, such as configuration data of a light source function, and attribute value, to a display generation means, A light source functional attribute record means to record attribute value, such as the self-luminous color and light source reinforcement, with relation with said light source function table present control means, A light source functional configuration location record means to record the configuration data which express a light source function with the relation between said object selected position computation means, said object preferential segregation processing means, or said light source function table present control means, and spatial position data, Said body expression control means The attribute modification direct-control system of the view and light source function which consists of a display generation means to draw to a display all the objects that performed view count and light source count based on the data from said view function table present control means, said light source function table present control means, and said cursor display-control means, and include three-dimension cursor It is having constituted.

[0013]

[Function] In this invention with the above-mentioned means, an operator does selection migration of the object with a three-dimension location and direction data required in order to move three-dimension cursor by operating input devices, such as the three-dimension location direction input device and a keyboard, and three-dimension cursor, or inputs the directions separated and arranged. An input-device control means reads in an input device the three-dimension location and direction data which the operator inputted, and various directions information, and a three-dimension location and direction data are passed to a three-dimension system-of-coordinates location and a direction modification means, and it passes directions information to instruction distinction and an executive operation means.

[0014] With a three-dimension system-of-coordinates location and a direction modification means, the three-dimension location and direction data from the three-dimension location direction input device are changed into the logical three-dimension virtual space coordinate value currently dealt with by the system of this example. With the cursor advance location direction count means, while calculating the spatial position of new three-dimension cursor based on the location and direction data changed with the three-dimension system-of-coordinates location and the direction modification means, the location data of the three-dimension cursor currently recorded by the cursor configuration location record means are updated. The cursor advance location direction count means starts an object selected position computation means next. With an object selected position computation means, the configuration location data of all the objects in [the configuration location record means of each object to] a three-dimension virtual space are read for the present spatial position data of three-dimension cursor from a cursor configuration location record means, and contact count with three-dimension cursor and all objects is performed. The spatial position data of the existence of contact, a contact object identification number, the part identification number for contact that showed the contact part of a still more exact three-dimension cursor and object, and the three-dimension cursor at the time of contact are recorded on a selection condition object record means as a result of this count. The three-dimension cursor location data at the time of this contact are used when calculating deformation from the movement magnitude of cursor, in case the configuration of an object is made to deform and that attribute is changed.

[0015] In the control means for actuation, if the selection directions with the three-dimension cursor from instruction distinction and an executive operation means and an object and selection discharge directions are received, the actuation condition of an object with decision and the three-dimension cursor of the existence of a contact object will be judged based on the information from a selection condition object record means, and this information will be recorded on it at a selection condition object record means. Furthermore, a selection demand or a selection discharge demand is published with an object identification number based on this information to an object preferential segregation processing means to perform processing which moves and arranges an object, or an attribute modification processing means for actuation to perform processing which changes the attribute of an object from that

configuration is started.
[0016] With an object preferential segregation processing means, the demand and assignment object identification number data which are outputted from the control means for actuation are followed. In order to move the assignment object holding the physical relationship of three-dimension cursor and an assignment object or to separate and arrange three-dimension cursor and an assignment object The configuration location data of the object specified out of each configuration location record means in the location data of three-dimension cursor are read from a cursor configuration location record means, and after performing three-dimension geometry count, the configuration location data of an assignment object are updated.
[0017] With the attribute modification processing means for actuation, the attribute change request from the control means for actuation starts. The contact object identification number and contact part identification number which are recorded on the selection object record means, and the three-dimension cursor spatial position data at the time of contact, Furthermore, deformation movement magnitude and the direction of [for making the configuration which visualized the attribute value of each object deform based on the tolerance and the constraint of attribute modification which are recorded on the attribute deformation art record means] are calculated, each expression processing means is started, and the attribute configuration of an object is made to change. It can come, simultaneously a cursor display-control means is made to control delivery, and the motion and display of three-dimension cursor at the time of attribute modification for the deformation movement magnitude and direction data for which it calculated and asked. The deformation movement magnitude and the direction of the attribute configuration searched for by this count is searched for from the tolerance and the constraint data of attribute modification on the basis of the relative amount by the difference of the three-dimension cursor-location data at the time of the object contact currently recorded on the selection condition object record means, and the location data of three-dimension cursor read from the cursor configuration location record means after attribute modification actuation assignment decision.
[0018] In a body expression control means, by the demand from the expression attribute modification processing means for actuation, the body configuration data in a body configuration location record means are updated, and the attribute value of the assignment body in a body attribute record means is updated according to these contents of configuration modification. Moreover, by the demand from a display generation means, configuration data required in order to display each body, location data, and attribute data are read from a body configuration and a location record means, or a body configuration and a location record means, and a display generation means is passed.
[0019] In a view function table present control means, by the demand from the expression attribute modification processing means for actuation, the configuration data of the view function in a view functional configuration location record means are updated, and the attribute value in a view functional attribute record means is updated according to the contents of updating of this configuration. Moreover, the view functional attribute data from a view functional attribute record means required in order to perform a display and view computation of a view functional configuration, and the configuration location data from a view functional configuration location record means are passed to a display generation means by the demand from a display generation means.
[0020] In a light source function table present control means, by the demand from the expression attribute modification processing means for actuation, the configuration data of the light source function in a light source functional configuration location record means are updated, and the attribute of the assignment light source kind in a light source functional attribute record means is updated according to the contents of updating of this configuration. Moreover, the light source functional attribute data from a light source functional attribute record means required in order to perform a display and light source computation of a light source functional configuration, and the configuration location data from a light source functional configuration location record means are passed to a display generation means by the demand from a display generation means.
[0021] With a display generation means, view count and light source computation are performed based on the various data from a cursor expression control means, a body expression control means, a view

function table present control means, and a light source function table present control means, and all objects including three-dimension cursor are drawn to a display.
[0022]
[Example] Hereafter, the example of this invention is explained, referring to a drawing. The block diagram in which drawing 1 shows the configuration of the example of this invention, the example [in / in drawing 2 / the example of this invention] of a component and the typical example of the display screen, the detailed example [in / in drawing 3 / the example of this invention] of an actuation screen, drawing 4 , and drawing 5 show the example of a modification actuation screen of the attribute value of the view function in the example of this invention, and a light source function.
[0023] By drawing 2 (a), an operator 27 has and moves the three-dimension location direction input unit 21 of the three-dimension location direction control unit 23 to a hand, and the place which is performing directions of operation to the system in this example is shown. The typical display screen in a display 26 is shown in 2a of drawing 2 (b). A three-dimension location and a direction are measured with the three-dimension location direction control device 23 from the three-dimension zero specification part 22, the location in the real space of the three-dimension location direction input unit 21, and the relation of a direction, a graphics computer 25 changes into the location and the direction data in the logical three-dimension virtual space system of coordinates which deal with this data within the computer, and the three-dimension cursor two a1 in screen 2a of a display 26 follows and moves to a motion of the three-dimension location direction input unit 21. The tip of the three-dimension cursor two a1 describes either of the objects, such as the light source kind location configuration two a5 which visualized the view location configuration two a4 which visualized the body two a2 in the three-dimension virtual space which wishes actuation of an operator, and the spatial position of two a3 or a view function, or the class and spatial position of a light source function. If selection directions are taken out from keyboard 24 grade, the object will be chosen, and with three-dimension cursor, a motion of the three-dimension location direction input unit 21 is followed, and it moves all over a virtual space.
[0024] The view function shown in screen 2a is expressed by the translucent view field configuration two a8 which shows the scope of the view function fixed to the front location of the view location configuration two a4 and this configuration. Moreover, the light source function shown in this screen 2a is expressed by the light source field configuration two a9 of the translucent cone form which shows the scope of the light source function fixed to the front location of the light source kind location configuration two a5 and this configuration. As for each of these configurations, a color and a configuration change with views, such as field-of-view depth, a light source kind, and light source reinforcement, or the attribute value of a light source function whenever [angle-of-visibility].
[0025] If the view location configuration two a4 in screen 2a and the light source kind location configuration two a5 choose, the view field configuration two a8 and the light source field configuration two a9 also hold connection physical relationship with the view location configuration two a4 or the light source kind location configuration two a5, and move in a three-dimension virtual space, and the effectiveness of each function which matched the spatial physical relationship of these configurations will be displayed on each window in screen 2a by real time.
[0026] When the view location configuration two a4 is moved, the scene within the view field configuration two a8 is displayed all over the sub drawing window two a6 as if the operator was looking from the view location configuration two a4. When the light source kind location configuration two a5 is moved, the scene by which the object within the light source field configuration two a9 was seasoned with the light source property is displayed directly on the Maine drawing window two a7 and the sub drawing window two a6. the same -- a three dimension -- a virtual space -- inside -- existing -- a body -- two -- a -- two -- two -- a -- three -- a view -- a location -- a configuration -- two -- a -- four -- the light source -- a seed -- a location -- a configuration -- two -- a -- five -- a menu -- etc. -- depending -- actuation -- an object -- a change -- directions -- nothing -- a three dimension -- cursor -- two -- a -- one -- always -- it can choose -- space -- inside -- migration - rotation -- actuation -- ** -- saying -- being the same -- an approach -- controlling -- things -- being possible .
[0027] Drawing 3 shows the relation between a screen display in this example when operating the view

function and the light source function, and a three-dimension locator. In order that drawing 3 (a) might operate the three-dimension location direction input unit 30, might move the three-dimension cursor 31 in a virtual space, might choose the view location configuration 32 and might look at only bodies 36 and 37 among bodies 36, 37, and 38, it just arranged the view field configuration 33 in the location and the direction which is made to move the view location configuration 32 and is shown in the screen of 3 (a). In order to make drawing 3 (b) fix in the location and direction which showed the view function all over the screen of 3 (a) and then to operate a light source function After issuing the separation directions with the view location configuration 32 and the three-dimension cursor 31 first, the three-dimension location direction input unit 30 is operated like an arrow head three b1, the three-dimension cursor 31 is moved to the location of the screen of 3 (b), and the place which chose the light source kind location configuration 34 is shown. Drawing 3 (c) carries out migration actuation of the three-dimension location direction input unit 30 like an arrow head 3c1, and it just moved the light source kind location configuration 34 so that the spot light source might irradiate this side from back toward the display screen of a body 38. At this time, the effectiveness of the spot light source function in which it followed in the spatial location and direction of in the virtual space of the light source kind location configuration 34 and the light source field configuration 35 is displayed on the sub drawing window 311 which shows the scene seen from the Maine drawing window 310 and the view location configuration. What is necessary is again, to carry out separation assignment of the connection of the light source kind location configuration 34 and the three-dimension cursor 31 and just to carry out the selection directions of the part of hope of the view location configuration 32 to operate a view function.

[0028] Modification actuation of a functional attribute is described using drawing 4 and drawing 5 . By drawing 4 , by making the configuration expressing the attribute value of a view function deform directly all over a screen shows the example of actuation in the case of changing the value. Top-most-vertices 42fpv of base (fur flat surface) 42fp of the tetrahedron of the view field configuration 42 is chosen with the three-dimension cursor 41 among the screen of 4 (a), and if it pulls up to slanting above one so that an arrow head four a1 may show, as shown in the screen of 4 (b), a fur flat surface will hold the aspect ratio, and will become large. It is displayed, as the attribute value of a view function is changed automatically, the scene in the sub drawing window 411 which displayed the scene within this configuration is also followed at deformation and it is shown in the screen of 4 (b) corresponding to deformation of this view field configuration. In 4 (c), as ridgeline 42fpe of fur flat-surface 42fp is further chosen with the three-dimension cursor 41 and it is shown in an arrow head 4c1, the condition of having pulled in the longitudinal direction is shown, in this case, the aspect ratio of a view field changes and the sub drawing window 411 serves as a wide display. Thus, the attribute which should be changed is judged by the system, the permissive conditions of the attribute which can be changed are followed, and the contents of deformation are determined and processed by the part of the configuration in which selection directions were done by the operator.

[0029] By drawing 5 , by making the configuration expressing the attribute value of a light source function deform directly all over a screen shows the example of actuation in the case of changing the value. The example of actuation when the example of actuation when five a1 of 5 (a) and five a2 have changed the attribute of the parallel light source, five b1 of 5 (b), and five b2 have changed the attribute of the point light source, 5c1 of 5 (c), and 5c2 are the examples of actuation when having changed the attribute of the spot light source. If it pulls in the direction which in the case of the parallel light source the configuration 52 which showed the direction of parallel light is chosen with the three-dimension cursor 51 as Screen five a1 shows, and is shown by arrow-head 5a1a, synchronizing with deformation of elongation and this configuration, the parallel luminous intensity in a screen will also change [a configuration] like 52 in Screen five a2. Screen five a2 shows the condition that the umbra by which light is not irradiated is small thinly by the increment in the reinforcement of the parallel light source. If it is made to move in the direction which in the case of the point light source the globular form front face 53 which shows the scope of the point light source is chosen with the three-dimension cursor 51 as Screen five b1 shows, and is shown by arrow-head 5b1a, the radius of a ball will become small like 53 in Screen five b2, this form status change form will be followed, the reinforcement of the point light

source in a screen will fall, and the field where the point light source is irradiated as shown in 53 will become small. The example same [of the point light source] also in the spot light source is indicated to be Screen 5c1 to 5c2.

[0030] Next, the configuration and actuation of this example are explained, referring to drawing 1 . In drawing 1 , each block shows a processing means and a line and an arrow head show the flow of data or a signal. First, a configuration is described. The input unit control means as which one inputs the space information and carbon button information from the three-dimension location direction control device or a keyboard among drawing, The three-dimension system-of-coordinates location and a direction modification means to change into the spatial position and direction value of the three-dimension virtual space system of coordinates which deal with 2 by the system based on the data from the three-dimension location direction control device, 3 calculates the new migration location of three-dimension cursor based on the data from a three-dimension system-of-coordinates location and the direction modification means 2. A cursor advance location direction count means to update the old data, and 4 record the configuration of three-dimension cursor, or The cursor configuration location record means which carries out updating record of the data from the cursor advance location direction count means, Instruction distinction and an executive operation means for 5 to distinguish the instruction of the object-choice directions from an operator, object-choice discharge directions, etc. with relation with an input unit control means, and to perform a suitable processing means, 6 based on the data from configuration location record means 13, 16, and 19 of each object by which the location data of the cursor configuration location record means 4 or each set elephant configuration are recorded by the demand from the cursor advance location direction count means 3 The number according to each set elephant well informed person which performs contact count with three-dimension cursor and each object, and contacts three-dimension cursor, Furthermore, the contact part identification number which shows exact contact parts, such as a ridgeline in this object configuration and top-most vertices, is extracted. The object selected position computation means sent to a selection condition object record means with the spatial position data of the three-dimension cursor at the time of contact, A selection condition object record means by which 7 records the spatial position data of the actuation condition and selection object identification number of an object with three-dimension cursor, a contact part identification number, or the three-dimension cursor at the time of contact based on the data from the object selected position computation means 6, 8 distinguishes the actuation condition of an object with three-dimension cursor based on the data from the selection condition object record means 7 in response to the object-choice demand from instruction distinction and the executive operation means 5, or an object-choice discharge demand. The control means for actuation which controls the processing which follows this actuation condition, and moves and arranges the candidate for contact while recording that result on the selection condition object record means 7, and the processing which changes the attribute of an object, 9 by the demand from the control means 8 for actuation based on the data from the cursor configuration location record means 4 or the configuration location record means 13, 16, and 19 of each object An object preferential segregation processing means to perform processing which is made to move a selection object all over a three-dimension virtual space, or separates and arranges the object under three-dimension cursor and selection, 10 refers to the attribute changing condition currently recorded on the attribute deformation processing condition record means 101 by the demand from the control means for actuation based on the data from the selection condition object record means 7 and the cursor configuration location record means 4. An attribute modification processing means for actuation to start the expression control means 11, 14, and 17 which create the data for changing the attribute of an object and actually change the attribute and configuration according to each set elephant, An attribute deformation processing condition record means by which, as for 101, the constraint of the modification tolerance of the attribute, the location, a direction which can change a configuration, etc., etc. is recorded according to each set elephant from relation with the attribute modification processing means 10 for actuation, A cursor display-control means to control migration and a display of the three-dimension cursor with which 102 is restrained by the deformation direction and location of the configuration at the time of the target attribute modification with relation with the attribute modification processing means

10 for actuation, The contents of deformation of the configuration which 11 updated the configuration data of the target body with relation with the attribute modification processing means 10 for actuation, and was changed if needed are followed. Change objective attribute value data or The body expression control means which transmits data required in order to draw a body to the display generation means 20, A body attribute record means by which 12 carries out updating record of the attribute value, such as a color of each body, and a feeling of the quality of the material, with relation with the body expression control means 11, A body configuration location record means by which 13 carries out updating record of objective configuration data and spatial position data with the relation between the object selected position computation means 6, the object preferential segregation processing means 9, or the body expression control means 11, The contents of deformation of the configuration which 14 updated the configuration data of a view function with relation with the attribute modification processing means 10 for actuation, and was changed if needed are followed. Change the attribute value of a view function or The view function table present control means which transmits information, such as configuration data of a view function, and attribute value, to the display generation means 20, A view functional attribute record means by which 15 carries out updating record of the attribute value of whenever [angle-of-visibility], a visual field field, etc. with relation with the view function table present control means 14, The view functional configuration location record means which carries out updating record of the configuration data as which 16 expresses a view function with the relation between the object selected position computation means 6, the object preferential segregation processing means 9, or the view function table present control means 14, or the spatial position data, The contents of deformation of the configuration which 17 updated the configuration data of a light source function with relation with the attribute modification processing means 10 for actuation, and was changed if needed are followed. Change the attribute value of a light source function, or The light source function table present control means which transmits information, such as configuration data of a light source function, and attribute value, to the display generation means 20, A light source functional attribute record means by which 18 records attribute value, such as the self-luminous color and light source reinforcement, with relation with the light source function table present control means 17, A light source functional configuration location record means to record the configuration data as which 19 expresses a light source function with the relation between the object selected position computation means 6, the object preferential segregation processing means 9, or the light source function table present control means 17, and spatial position data, 20 is a display generation means to draw to a display all the objects that performed view count and light source count based on the data from the body expression control means 8, the view function table present control means 12, the light source function table present control means 16, and the cursor display-control means 4, and include three-dimension cursor. Next, the actuation during each configuration is described. An operator does selection migration of the object with a three-dimension location and direction data required in order to move three-dimension cursor by operating input devices, such as the three-dimension location direction input device and a keyboard, and three-dimension cursor, or inputs the directions separated and arranged. The input-device control means 1 reads in an input device the three-dimension location and direction data which the operator inputted, and various directions information, and a three-dimension location and direction data are passed to a three-dimension system-of-coordinates location and the direction modification means 2, and it passes directions information to instruction distinction and the executive operation means 5.

[0031] With a three-dimension system-of-coordinates location and the direction modification means 2, the three-dimension location and direction data from the three-dimension location direction input device are changed into the logical three-dimension virtual space coordinate value currently dealt with by the system of this example. With the cursor advance location direction count means 3, while calculating the spatial position of new three-dimension cursor based on the location and direction data changed with the three-dimension system-of-coordinates location and the direction modification means 2, the location data of the three-dimension cursor currently recorded by the cursor configuration location record means 4 are updated. The cursor advance location direction count means 3 starts the object selected position computation means 6 next. With the object selected position computation means 6, the configuration

location data of all the objects in [the configuration location record means 13, 16 and 19 of each object to] a three-dimension virtual space are read for the present spatial position data of three-dimension cursor from the cursor configuration location record means 4, and contact count with three-dimension cursor and all objects is performed. The spatial position data of the existence of contact, a contact object identification number, the part identification number for contact that showed the contact part of a still more exact three-dimension cursor and object, and the three-dimension cursor at the time of contact are recorded on the selection condition object record means 7 as a result of this count. The three-dimension cursor location data at the time of this contact are used when calculating deformation from the movement magnitude of cursor, in case the configuration of an object is made to deform and that attribute is changed.

[0032] In the control means 8 for actuation, if the selection directions with the three-dimension cursor from instruction distinction and the executive operation means 5 and an object and selection discharge directions are received, the actuation condition of an object with decision and the three-dimension cursor of the existence of a contact object will be judged based on the information from the selection condition object record means 7, and this information will be recorded on it at the selection condition object record means 7. Furthermore, a selection demand or a selection discharge demand is published with an object identification number based on this information to an object preferential segregation processing means 9 to perform processing which moves and arranges an object, or an attribute modification processing means 10 for actuation to perform processing which changes the attribute of an object from that configuration is started.

[0033] With the object preferential segregation processing means 9, the demand and assignment object identification number data which are outputted from the control means 8 for actuation are followed. In order to move the assignment object holding the physical relationship of three-dimension cursor and an assignment object or to separate and arrange three-dimension cursor and an assignment object The configuration location data of the object specified in the location data of three-dimension cursor out of each configuration location record means 13, 16, or 19 are read from the cursor configuration location record means 4, and after performing three-dimension geometry count, the configuration location data of an assignment object are updated.

[0034] With the attribute modification processing means 10 for actuation, the attribute change request from the control means 8 for actuation starts. The contact object identification number and contact part identification number which are recorded on the selection object record means 7, and the three-dimension cursor spatial position data at the time of contact, Furthermore, deformation movement magnitude and the direction of [for making the configuration which visualized the attribute value of each object deform based on the tolerance and the constraint of attribute modification which are recorded on the attribute deformation art record means 101] are calculated, each expression processing means 11, 14, and 17 are started, and the attribute configuration of an object is made to change. It can come, simultaneously the cursor display-control means 102 is made to control delivery, and the motion and display of three-dimension cursor at the time of attribute modification for the deformation movement magnitude and direction data for which it calculated and asked. a base [amount / by the difference of the three-dimension cursor-location data at the time of the object contact to which the deformation movement magnitude and the direction of the attribute configuration searched for by this count is recorded on the selection condition object record means 7, and the location data of three-dimension cursor which read from a cursor configuration location record means 4 after attribute modification actuation assignment decision / relative] -- carrying out -- the tolerance and the constraint data of attribute modification -- since -- it is asked.

[0035] In the body expression control means 11, by the demand from the expression attribute modification processing means 10 for actuation, the body configuration data in the body configuration location record means 13 are updated, and the attribute value of the assignment body in the body attribute record means 12 is updated according to these contents of configuration modification. Moreover, by the demand from the display generation means 20, configuration data required in order to display each body, location data, and attribute data are read from a body configuration and the location

record means 13, or a body configuration and a location record means 12, and the display generation means 20 is passed.
[0036] In the view function table present control means 14, by the demand from the expression attribute modification processing means 10 for actuation, the configuration data of the view function in the view functional configuration location record means 16 are updated, and the attribute value in the view functional attribute record means 15 is updated according to the contents of updating of this configuration. Moreover, the view functional attribute data from the view functional attribute record means 15 required in order to perform a display and view computation of a view functional configuration, and the configuration location data from the view functional configuration location record means 16 are passed to the display generation means 20 by the demand from the display generation means 20.
[0037] In the light source function table present control means 17, by the demand from the expression attribute modification processing means 10 for actuation, the configuration data of the light source function in the light source functional configuration location record means 13 are updated, and the attribute of the assignment light source kind in the light source functional attribute record means 18 is updated according to the contents of updating of this configuration. Moreover, the light source functional attribute data from the light source functional attribute record means 18 required in order to perform a display and light source computation of a light source functional configuration, and the configuration location data from the light source functional configuration location record means 19 are passed to the display generation means 20 by the demand from the display generation means 20.
[0038] With the display generation means 20, view count and light source computation are performed based on the various data from the cursor expression control means 102, the body expression control means 11, the view function table present control means 14, and the light source function table present control means 17, and all objects including three-dimension cursor are drawn to a display.
[0039] while the space direct-control system of a view and a light source function can show an operator the attribute of a view function or a light source function in a three-dimension configuration visually above according to this example, the arbitration part of a view or the configuration of a light source function is refer to as choose directly and move in a virtual space like actuation of a body -- it is easy and the actuation which carried out 1 practice, and, moreover, the object of arbitration can choose without the change assignment for actuation at any time. Moreover, each functional effect corresponding to space actuation of a view functional configuration or a light source functional configuration also becomes possible [displaying on real time]. Furthermore, the attribute value can be changed by inputting neither a numeric value nor a notation from a menu etc., but deforming directly the configuration which visualized the attribute of a view function or a light source function in a three-dimension virtual space. By these functions, compared with the three-dimension information processing system which supported actuation of the conventional view function or a light source function, an operator can grasp now intuitively the contents of an attribute of a view function all over a three-dimension virtual space, or a light source function, and the space position relation between a function and an object, and can operate each function now easily and quickly in the location and the direction which he means. Moreover, since an operator can change attribute value visually by deforming soon the configuration which the attribute visualized, without changing attribute value with the numeric value and notation which cannot predict an attribute modification result easily, attribute modification of an intuitive and easy function of him is attained.
[0040]
[Effect of the Invention] According to this invention, three-dimension information processing system can express visually to an operator by the ability making an attribute required for actuation of a view function or a light source function into a three-dimension configuration so that clearly from the above explanation, and the arbitration part of the configuration can be directly chosen and moved in a three-dimension virtual space. Moreover, since this actuation is followed and the effectiveness of each actuation function is displayed interactively So that the space position relation between the attribute of a view function or a light source function, an object, and these functions can be intuitively grasped now all

over a three-dimension virtual space and an operator may operate lighting systems, such as vision equipments, such as video, and a lamp, daily in the real world A view function and a light source function can be operated now easily and quickly in the location and the direction which he means.
[0041] furthermore, since the configuration which visualized the attribute soon can be deformed and the effectiveness by attribute modification is also immediately confirmed by the eye even if it does not input with the numeric value or notation with which an operator cannot predict an attribute modification result easily even if it faces attribute modification of a view function or a light source function, the function in which it is alike as an intention of an operator can be made intuitively and easily.
[0042] Thereby, an operator can obtain now easily the image scene and light source scene in the head to imagine.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Industrial Application] This invention relates to the interface method for operating easily and efficiently the view function and light source function which are used with the three-dimension information processing system which supports the design of the industrial design of a three-dimension configuration using the computer graphics equipment which can draw a three-dimension configuration at a high speed, construction, a machine, etc.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] The three-dimension information processing system which has the control function of the view which equipped the indicating equipment 61 and the two-dimensional input device 62 (mouse) which are shown in drawing 6 , and the keyboard 63, or the light source existed in the former. Usually, first, the operator 64 who uses such a system operates the two-dimensional input unit 62, moves the cursor 66 which can move the screen 65 top of a display 61 only to level and a perpendicular direction to up to the assignment menu 67 for actuation, and specifies his interested candidate for actuation. The menu for actuation has the body actuation 68, the view actuation 69, and the light source actuation 610, and only the specified object becomes operational. If the candidate for actuation is decided, a hierarchy sub menu will appear in 611 and will perform still more detailed assignment of a view, a light source attribute, etc. according to each set elephant.
[0003] Drawing 7 is an example of the actuation screen of the conventional view function. If an operator specifies the view actuation menu 75, the view configurations 73, such as a camera in which a view modification function is shown, will be displayed on the Maine drawing window 72 in the display screen 71, and the scene in the three-dimension virtual space seen from the location where it can come, simultaneously this configuration exists will be displayed on another sub drawing window 74. An operator can see the scene from various location and directions in the sub drawing window 74 by moving cursor 76 all over the Maine drawing window 72 using an input unit, and rotating [it is / this configuration / parallel and] it all over a three-dimension virtual space. In addition, the reference point of the parallel and rotation in the three-dimension virtual space of this view configuration is beforehand decided by the system.
[0004] Rotation and parallel translation actuation of a view configuration are performed by moving a two-dimensional input device to order and right and left on a desk, pushing the specific carbon button with which the specific key and specific two-dimensional input device on a keyboard are equipped. Make level and a perpendicular direction carry out a parallel displacement, it is made to rotate to the circumference of the shaft of level and a perpendicular direction, or the parallel displacement of the view configuration is made to carry out [according to concomitant use of depression actuation of this carbon button and migration actuation of an input unit] in the depth direction toward a display from an operator on a Maine drawing window. An operator moves a view configuration in the spatial position and the direction which he means, considering the combination of these actuation.
[0005] Drawing 8 is an example of the actuation screen of the conventional light source modification function. There are three kinds, the parallel light source, the point light source, and the spot light source, in (a) of drawing 8 , (b) of drawing 8 shows a point light source configuration, and (c) of drawing 8 shows the spot light source configuration to the light source kind for the parallel light source configuration. These light source kinds are specified with the hierarchy sub menu eight a11 displayed after assignment of light source actuation. Since it is almost the same, actuation of each light source is henceforth described focusing on the case of the parallel light source. With the hierarchy sub menu eight a11 displayed after assignment of light source actuation, if actuation of the parallel light source is specified, as shown in (a) of drawing 8 The light source configuration eight a3 of line drawings, such as

an arrow head which shows the direction of the parallel light source, is displayed on the drawing window eight a2 in the display screen eight a1, and the scene which could come, simultaneously followed the parallel light source property is drawn all over the same drawing window eight a2. An operator can see the light source scene when turning the parallel light source in the various directions by moving cursor all over a drawing window and rotating [it is / the parallel light source configuration eight a3 / parallel, and] it all over a three-dimension virtual space, using an input unit. In addition, the reference point of actuation of this light source configuration is decided by the system like the case of view actuation.

[0006] Since it is the same as a view function, basic operation is omitted. Drawing 9 is the block diagram showing the structure of a system conventionally [above mentioned]. A line and an arrow head show data flow among drawing. Usually, the input-device control means 91 controls a two-dimensional input device and a keyboard, and receives X from a two-dimensional input device, and two-dimensional location data and carbon button information on Y. Among this data, drawing to the new migration location of cursor is performed here using the cursor drawing means 916 at the same time two-dimensional location data are changed into the physical screen position-coordinate value of a display by the image system-of-coordinates transform-processing means 92. The change demand for actuation, the rotation and the parallel displacement actuation demand for actuation, and the attribute change request for actuation judge, and the directions from the present operator start according to each demand with instruction distinction and an executive-operation means 93 in the change processing means 94 for actuation, the control means 96 for actuation, or the attribute modification processing means 98 for actuation by this screen position-coordinate value and the carbon button information on the two-dimensional input device from the input-device control means 91, or a keyboard.

[0007] If starting starts the change processing means 94 for actuation, the identification number of the actuation object passed from instruction distinction and the executive operation means 94 will be recorded on the actuation object record means 95.

[0008] Moreover, if starting starts the control means 96 for actuation, the two-dimensional location data of the input device passed from instruction distinction and the executive operation means 93 will be first changed into the coordinate value in a three-dimension virtual space using a three-dimension system-of-coordinates location and the direction computation means 97. Next, from the actuation object record means 95, the present actuation object identification number is read and the location and the direction computation means 911, 99, or 913 of the actuation object which the identification number shows are started. For example, in the view migration location direction count means 99, when the actuation object identification number shows the body and it shows the view function for the body migration location direction count means 911, when the light source function is shown, the light source migration location direction count means 913 is started. With each migration location direction count means, based on the three-dimension coordinate data calculated with the actuation object identification number, and a three-dimension system-of-coordinates location and a direction computation means 97, new spatial position and direction for [each] actuation are calculated, and the location and direction data of each configuration and attribute record means 912, 910, or 914 of a body, a view, and the light source are updated. With the display generation means 915, all the objects that exist all over a three-dimension virtual space are drawn to a display based on configuration geometry data and attribute data from a body configuration and the attribute record means 912, a visual field configuration and an attribute record means 910, and a light source configuration and an attribute record means 913.

[0009] Furthermore, if starting starts the attribute modification processing means 98 for actuation, the attribute value specified by [which read the present actuation object identification number, was inputted by the actuation object record means 95 from the present attribute value and the present input unit control means 91 in each configuration and attribute record means 912, 910, or 914 of a body, a view, and the light source that the identification number was followed, and entered via instruction distinction and the executive-operation means 93 from it first] an operator will exchange.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, three-dimension information processing system can express visually to an operator by the ability making an attribute required for actuation of a view function or a light source function into a three-dimension configuration so that clearly from the above explanation, and the arbitration part of the configuration can be directly chosen and moved in a three-dimension virtual space. Moreover, since this actuation is followed and the effectiveness of each actuation function is displayed interactively, All over a three-dimension virtual space, the space position relation between the attribute of a view function or a light source function, an object, and these functions can be intuitively grasped now, and as an operator operates lighting systems, such as vision equipments, such as video, and a lamp, daily in the real world, he can operate now a view function and a light source function easily and quickly in the location and the direction which he means.
[0041] furthermore, since the configuration which visualized the attribute soon can be deformed and the effectiveness by attribute modification is also immediately confirmed by the eye even if it does not input with the numeric value or notation with which an operator cannot predict an attribute modification result easily even if it faces attribute modification of a view function or a light source function, the function in which it is alike as an intention of an operator can be made intuitively and easily.
[0042] Thereby, an operator can obtain now easily the image scene and light source scene in the head to imagine.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, since it was hard to understand the area of influence, and spatial spatial location and direction which these functions exert on a three-dimension virtual space visually in actuation of the view by the space direct-control system of conventional view and light source function mentioned above, or a light source function, it was difficult to operate the configuration expressing a view or a light source function, and to obtain the image scene and the light source scene of hope. Moreover, in if it must carry out after specifying the target change with a menu etc., also when operating an object called the body and view function which exist all over the same three-dimension virtual space, and a light source function According to if it must carry out considering the combination of two-dimensional actuation, such as rotation of X and Y shaft orientations, and a parallel displacement, when carrying out space actuation of each set elephant, the problem of the actuation reference point of each set elephant configuration being decided by the system, and being unable to change it It was difficult for the spatial position and the direction which he regarded as easy to operate a body, and a view and a light source function. Furthermore, also when it is going to make the view and light source function which changes attributes, such as visual field area size and light source reinforcement, and he means Since the contents of modification had judged whether it was the right after changing attribute value with the numeric value and notation which an attribute modification result cannot predict easily and actually operating the view and the light source function after attribute modification, much time amount was needed for making a view and a light source function with the attribute which an operator imagines.
[0011] This invention expresses the attribute of a view and a light source function visually as a 3-D graphic in view of the above-mentioned technical problem. An operator chooses the arbitration part of this 3-D graphic. Carry out space actuation directly or Moreover, by making it possible to change that attribute value by deforming this three-dimension configuration soon all over a virtual space, following migration actuation and deformation actuation of the configuration of a view and a light source function, and drawing change of each functional effect immediately The interface for obtaining quickly and easily the image scene and light source scene which are imagined in an operator's head is offered.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the attribute modification direct-control structure of a system of the view and light source function in one example of this invention
[Drawing 2] The example of an equipment configuration and the example of the display screen of a system in one example of this invention
[Drawing 3] The example of an actuation screen in one example of this invention
[Drawing 4] The example of an actuation screen of the visualization configuration of the view function in one example of this invention
[Drawing 5] The example of an actuation screen of the visualization configuration of the light source function in one example of this invention
[Drawing 6] The conventional example of an equipment configuration and the conventional example of the display screen in an example
[Drawing 7] The example of an actuation screen of the view function in the conventional example
[Drawing 8] The example of an actuation screen of the light source function in the conventional example

[Drawing 9] The block diagram showing the system configuration of the conventional example
[Description of Notations]
1 Input Unit Control Means
2 Three-Dimension System-of-Coordinates Location and Direction Modification Means
3 The Cursor Advance Location Direction Count Means
4 Cursor Configuration Location Record Means
5 Instruction Distinction and Executive Operation Means
6 Object Selected Position Computation Means
7 Selection Condition Object Record Means
8 Control Means for Actuation
9 Object Preferential Segregation Processing Means
10 Attribute Modification Processing Means for Actuation
101 Attribute Deformation Processing Condition Record Means
102 Cursor Display-Control Means
11 Body Expression Control Means
12 Body Attribute Record Means
13 Body Configuration Location Record Means
14 View Function Table Present Control Means
15 View Functional Attribute Record Means
16 View Functional Configuration Location Record Means
17 Light Source Function Table Present Control Means
18 Light Source Functional Attribute Record Means
19 Light Source Functional Configuration Location Record Means

20 Display Generation Means
21 The Three-Dimension Location Direction Input Unit
22 Three-Dimension Zero Specification Part
23 The Three-Dimension Location Direction Control Unit
24 Keyboard
25 Graphics Computer
26 High-Resolution-Graphics Display
2a The example of the display screen
Two a1 Three-dimension cursor
Two a2 Cube
Two a3 Tetrahedron
Two a4 View location configuration
Two a5 Light source kind location configuration
Two a6 Sub drawing window
Two a7 Maine drawing window
Two a8 View field configuration
Two a9 Light source field configuration
3a The example of an actuation screen
3b The example of an actuation screen
Three b1 Locus
3c The example of an actuation screen
3c1 Locus
30 The Three-Dimension Location Direction Input Unit
31 Three-Dimension Cursor
32 View Location Configuration
33 View Field Configuration
34 Light Source Kind Location Configuration
35 Light Source Field Configuration
36 Cube
37 Tetrahedron
38 Three Prism Objects
310 Maine Drawing Window
311 Sub Drawing Window
Four a1 The three-dimension cursor actuation direction
4c1 The three-dimension cursor actuation direction
42fp(s) Fur flat surface
42fpv(s) Top-most vertices of a fur flat surface
42fpe(s) Ridgeline of a fur flat surface
41 Three-Dimension Cursor
43 Visual Field Field Attribute Configuration
410 Maine Drawing Window
411 Sub Drawing Window
Five a1 Example of an actuation screen
5a1a The direction of an attribute form status change form
Five a2 Example of an actuation screen
Five b1 Example of an actuation screen
5b1a The direction of an attribute form status change form
51 Three-Dimension Cursor
62 Two-dimensional Input Unit
63 Keyboard
64 Operator

65 Display Screen
66 Two-dimensional Cursor
67 Menu Area
68 Body Operator Guidance Menu
69 View Operator Guidance Menu
610 Example of Light Source Operator Guidance Menu
611 Hierarchical Menu Field
71 Display Screen
72 Maine Drawing Window
73 Configuration Expressing View Function
74 Sub Drawing Window
75 Example of Menu Item
8a Actuation screen
Eight a1 Display screen
Eight a2 Drawing window
Eight a3 Configuration expressing the parallel light source
Eight a11 Hierarchical menu field
8b Actuation screen
Eight b1 Configuration expressing the point light source
8c The actuation screen of a spot light source function
8c1 Configuration expressing the spot light source
91 Input Unit Control Means
92 Screen System-of-Coordinates Transform-Processing Means
93 Instruction Distinction and Executive Operation Means
94 Change Processing Means for Actuation
95 Actuation Object Record Means
96 Control Means for Actuation
97 Three-Dimension System-of-Coordinates Location and Direction Computation Means
98 Attribute Modification Processing Means for Actuation
99 The View Migration Location Direction Count Means
910 View Configuration and Attribute Record Means
911 The Body Migration Location Direction Count Means
912 Body Configuration and Attribute Record Means
913 The Light Source Migration Location Direction Count Means
914 Light Source Configuration and Attribute Record Means
915 Display Generation Means
916 Cursor Drawing Means

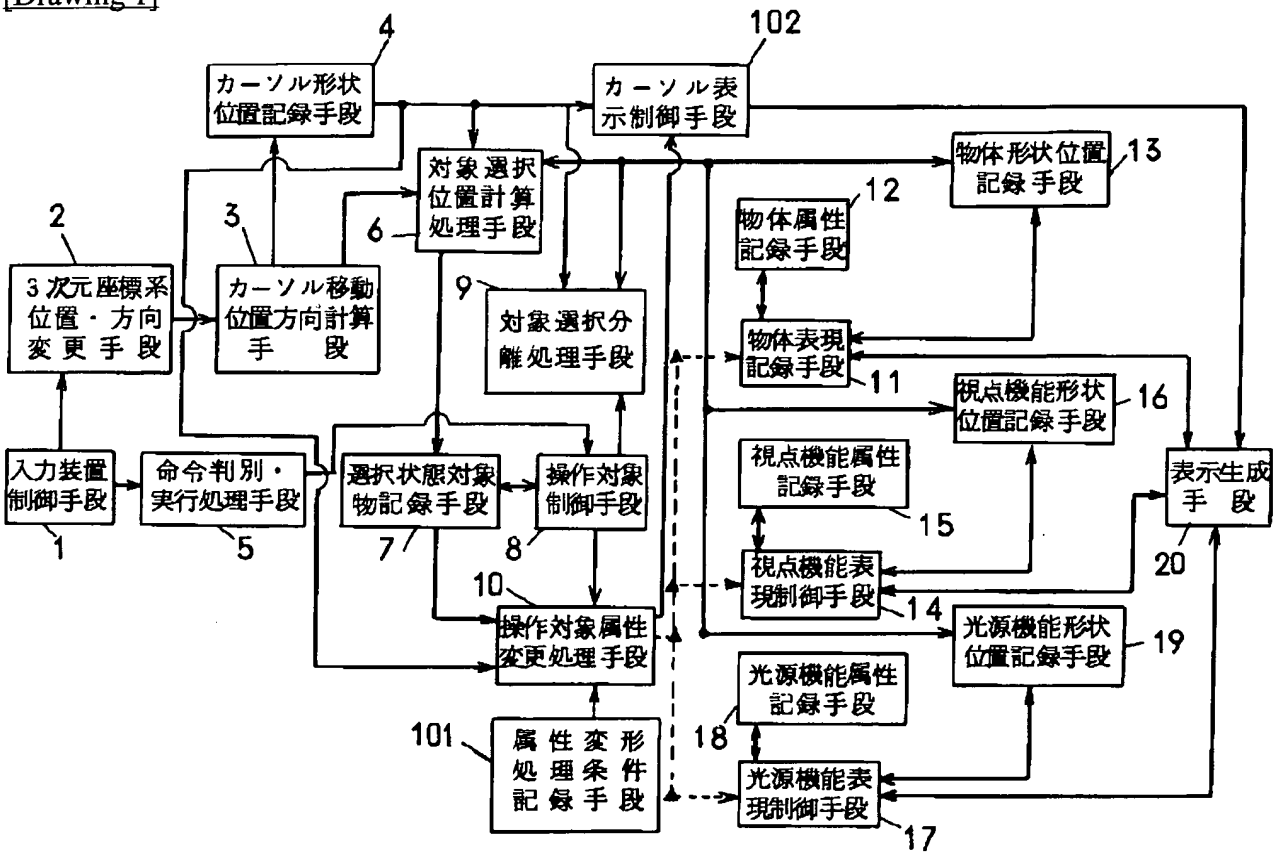
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

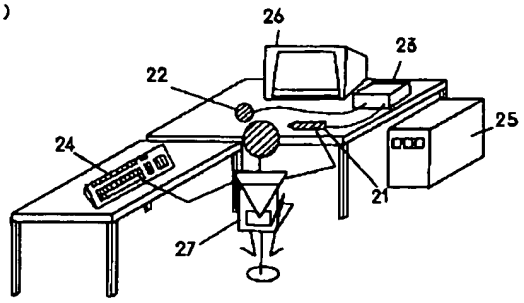
DRAWINGS

[Drawing 1]

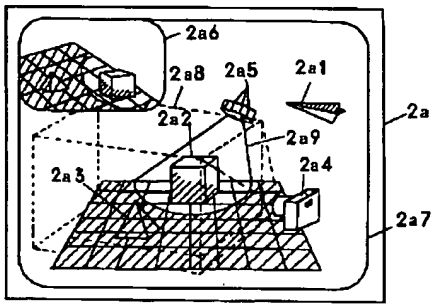


[Drawing 2]

(a)

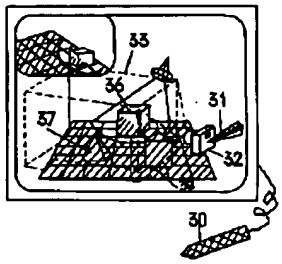


(b)

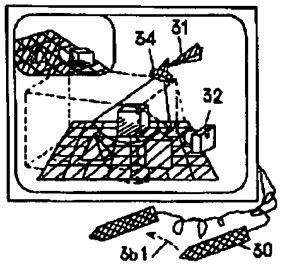


[Drawing 3]

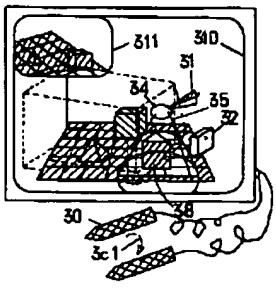
(a)



(b)

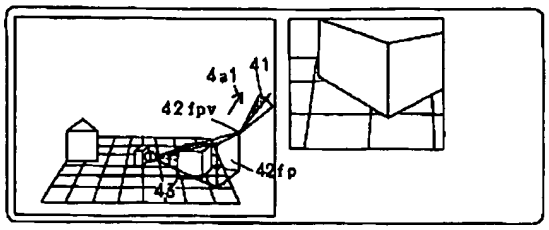


(c)

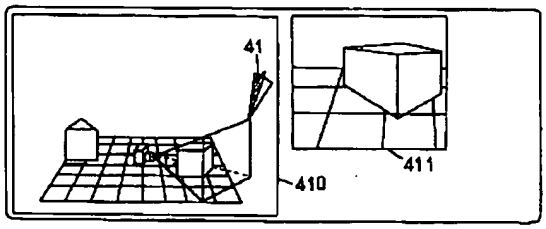


[Drawing 4]

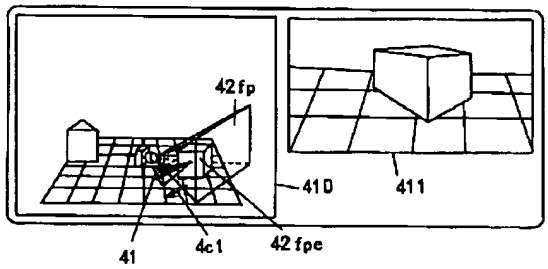
(a)



(b)

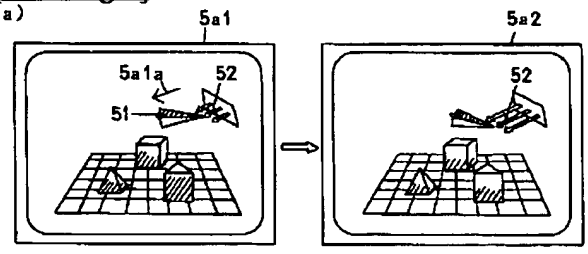


(c)

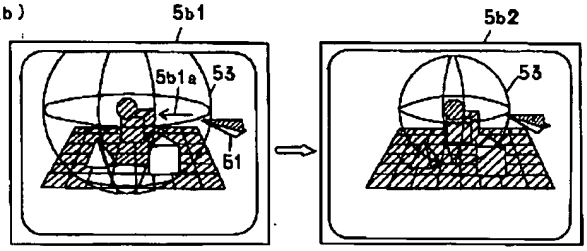


[Drawing 5]

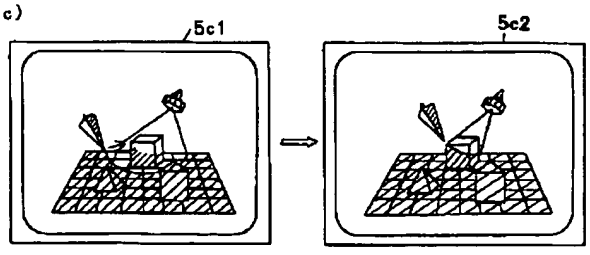
(a)



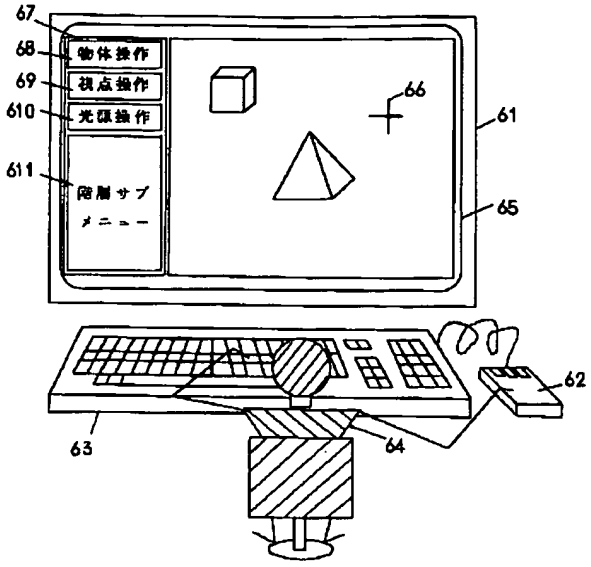
(b)



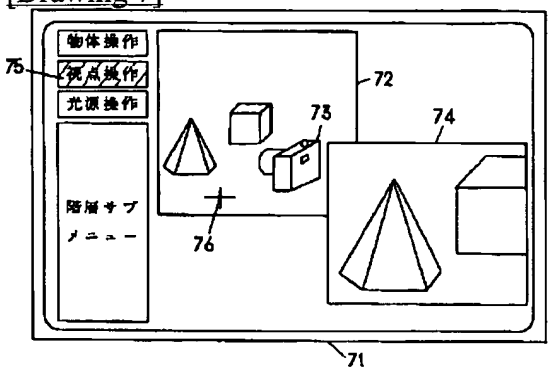
(c)



[Drawing 6]



[Drawing 7]

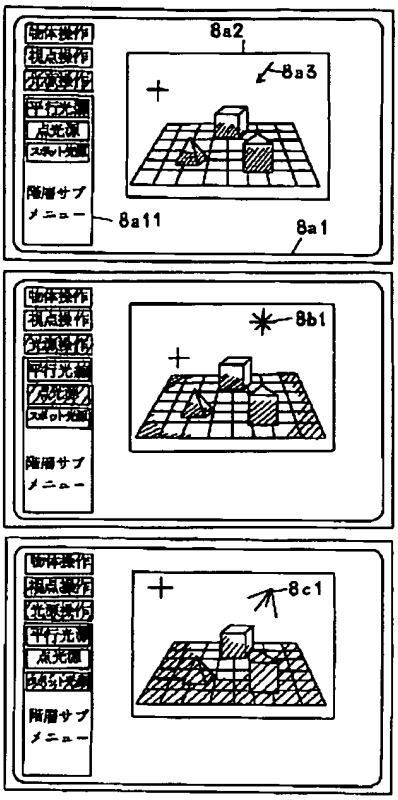


[Drawing 8]

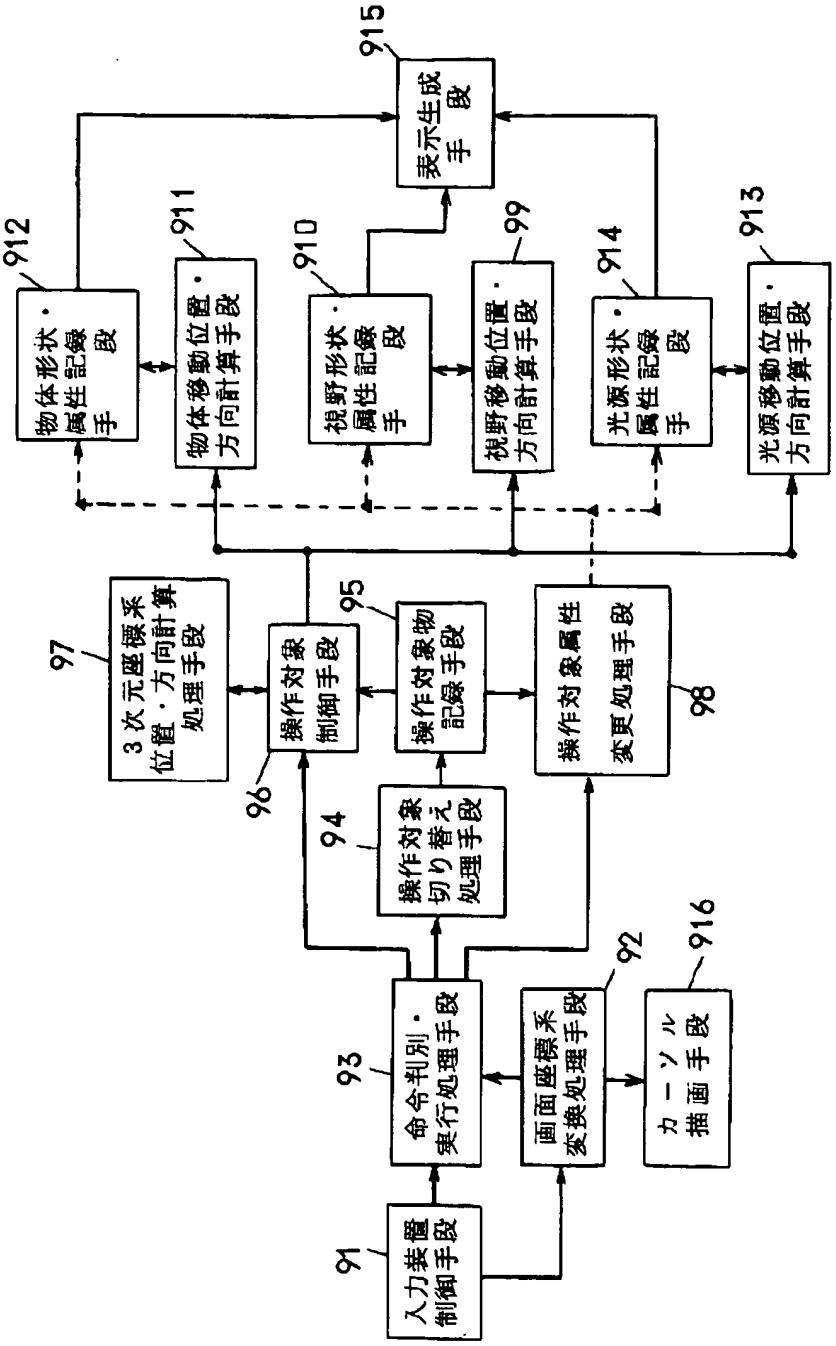
(a)

(b)

(c)



[Drawing 9]



[Translation done.]

* NOTICES *

EXAMPLE

[Example] Hereafter, the example of this invention is explained, referring to a drawing. The block diagram in which drawing 1 shows the configuration of the example of this invention, the example [in / in drawing 2 / the example of this invention] of a component and the typical example of the display screen, the detailed example [in / in drawing 3 / the example of this invention] of an actuation screen, drawing 4 , and drawing 5 show the example of a modification actuation screen of the attribute value of the view function in the example of this invention, and a light source function.
[0023] By drawing 2 (a), an operator 27 has and moves the three-dimension location direction input unit 21 of the three-dimension location direction control unit 23 to a hand, and the place which is performing directions of operation to the system in this example is shown. The typical display screen in a display 26 is shown in 2a of drawing 2 (b). A three-dimension location and a direction are measured with the three-dimension location direction control device 23 from the three-dimension zero specification part 22, the location in the real space of the three-dimension location direction input unit 21, and the relation of a direction, a graphics computer 25 changes into the location and the direction data in the logical three-dimension virtual space system of coordinates which deal with this data within the computer, and the three-dimension cursor two a1 in screen 2a of a display 26 follows and moves to a motion of the three-dimension location direction input unit 21. The tip of the three-dimension cursor two a1 describes either of the objects, such as the light source kind location configuration two a5 which visualized the view location configuration two a4 which visualized the body two a2 in the three-dimension virtual space which wishes actuation of an operator, and the spatial position of two a3 or a view function, or the class and spatial position of a light source function. If selection directions are taken out from keyboard 24 grade, the object will be chosen, and with three-dimension cursor, a motion of the three-dimension location direction input unit 21 is followed, and it moves all over a virtual space.
[0024] The view function shown in screen 2a is expressed by the translucent view field configuration two a8 which shows the scope of the view function fixed to the front location of the view location configuration two a4 and this configuration. Moreover, the light source function shown in this screen 2a is expressed by the light source field configuration two a9 of the translucent cone form which shows the scope of the light source function fixed to the front location of the light source kind location configuration two a5 and this configuration. As for each of these configurations, a color and a configuration change with views, such as field-of-view depth, a light source kind, and light source reinforcement, or the attribute value of a light source function whenever [angle-of-visibility].
[0025] If the view location configuration two a4 in screen 2a and the light source kind location configuration two a5 choose, the view field configuration two a8 and the light source field configuration two a9 also hold connection physical relationship with the view location configuration two a4 or the light source kind location configuration two a5, and move in a three-dimension virtual space, and the effectiveness of each function which matched the spatial physical relationship of these configurations will be displayed on each window in screen 2a by real time.
[0026] When the view location configuration two a4 is moved, the scene within the view field configuration two a8 is displayed all over the sub drawing window two a6 as if the operator was looking

from the view location configuration two a4. When the light source kind location configuration two a5 is moved, the scene by which the object within the light source field configuration two a9 was seasoned with the light source property is displayed directly on the Maine drawing window two a7 and the sub drawing window two a6. the same -- a three dimension -- a virtual space -- inside -- existing -- a body -- two -- a -- two -- two -- a -- three -- a view -- a location -- a configuration -- two -- a -- four -- the light source -- a seed -- a location -- a configuration -- two -- a -- five -- a menu -- etc. -- depending -- actuation -- an object -- a change -- directions -- nothing -- a three dimension -- cursor -- two -- a -- one -- always -- it can choose -- space -- inside -- migration - rotation -- actuation -- ** -- saying -- being the same -- an approach -- controlling -- things -- being possible .

[0027] Drawing 3 shows the relation between a screen display in this example when operating the view function and the light source function, and a three-dimension locator. In order that drawing 3 (a) might operate the three-dimension location direction input unit 30, might move the three-dimension cursor 31 in a virtual space, might choose the view location configuration 32 and might look at only bodies 36 and 37 among bodies 36, 37, and 38, it just arranged the view field configuration 33 in the location and the direction which is made to move the view location configuration 32 and is shown in the screen of 3 (a). In order to make drawing 3 (b) fix in the location and direction which showed the view function all over the screen of 3 (a) and then to operate a light source function After issuing the separation directions with the view location configuration 32 and the three-dimension cursor 31 first, the three-dimension location direction input unit 30 is operated like an arrow head three b1, the three-dimension cursor 31 is moved to the location of the screen of 3 (b), and the place which chose the light source kind location configuration 34 is shown. Drawing 3 (c) carries out migration actuation of the three-dimension location direction input unit 30 like an arrow head 3c1, and it just moved the light source kind location configuration 34 so that the spot light source might irradiate this side from back toward the display screen of a body 38. At this time, the effectiveness of the spot light source function in which it followed in the spatial location and direction of in the virtual space of the light source kind location configuration 34 and the light source field configuration 35 is displayed on the sub drawing window 311 which shows the scene seen from the Maine drawing window 310 and the view location configuration. What is necessary is again, to carry out separation assignment of the connection of the light source kind location configuration 34 and the three-dimension cursor 31 and just to carry out the selection directions of the part of hope of the view location configuration 32 to operate a view function.

[0028] Modification actuation of a functional attribute is described using drawing 4 and drawing 5 . By drawing 4 , by making the configuration expressing the attribute value of a view function deform directly all over a screen shows the example of actuation in the case of changing the value. Top-most-vertices 42fpv of base (fur flat surface) 42fp of the tetrahedron of the view field configuration 42 is chosen with the three-dimension cursor 41 among the screen of 4 (a), and if it pulls up to slanting above one so that an arrow head four a1 may show, as shown in the screen of 4 (b), a fur flat surface will hold the aspect ratio, and will become large. It is displayed, as the attribute value of a view function is changed automatically, the scene in the sub drawing window 411 which displayed the scene within this configuration is also followed at deformation and it is shown in the screen of 4 (b) corresponding to deformation of this view field configuration. In 4 (c), as ridgeline 42fpe of fur flat-surface 42fp is further chosen with the three-dimension cursor 41 and it is shown in an arrow head 4c1, the condition of having pulled in the longitudinal direction is shown, in this case, the aspect ratio of a view field changes and the sub drawing window 411 serves as a wide display. Thus, the attribute which should be changed is judged by the system, the permissive conditions of the attribute which can be changed are followed, and the contents of deformation are determined and processed by the part of the configuration in which selection directions were done by the operator.

[0029] By drawing 5 , by making the configuration expressing the attribute value of a light source function deform directly all over a screen shows the example of actuation in the case of changing the value. The example of actuation when the example of actuation when five a1 of 5 (a) and five a2 have changed the attribute of the parallel light source, five b1 of 5 (b), and five b2 have changed the attribute of the point light source, 5c1 of 5 (c), and 5c2 are the examples of actuation when having changed the

attribute of the spot light source. If it pulls in the direction which in the case of the parallel light source the configuration 52 which showed the direction of parallel light is chosen with the three-dimension cursor 51 as Screen five a1 shows, and is shown by arrow-head 5a1a, synchronizing with deformation of elongation and this configuration, the parallel luminous intensity in a screen will also change [a configuration] like 52 in Screen five a2. Screen five a2 shows the condition that the umbra by which light is not irradiated is small thinly by the increment in the reinforcement of the parallel light source. If it is made to move in the direction which in the case of the point light source the globular form front face 53 which shows the scope of the point light source is chosen with the three-dimension cursor 51 as Screen five b1 shows, and is shown by arrow-head 5b1a, the radius of a ball will become small like 53 in Screen five b2, this form status change form will be followed, the reinforcement of the point light source in a screen will fall, and the field where the point light source is irradiated as shown in 53 will become small. The example same [of the point light source] also in the spot light source is indicated to be Screen 5c1 to 5c2.

[0030] Next, the configuration and actuation of this example are explained, referring to drawing 1 . In drawing 1 , each block shows a processing means and a line and an arrow head show the flow of data or a signal. First, a configuration is described. The input unit control means as which one inputs the space information and carbon button information from the three-dimension location direction control device or a keyboard among drawing, The three-dimension system-of-coordinates location and a direction modification means to change into the spatial position and direction value of the three-dimension virtual space system of coordinates which deal with 2 by the system based on the data from the three-dimension location direction control device, 3 calculates the new migration location of three-dimension cursor based on the data from a three-dimension system-of-coordinates location and the direction modification means 2. A cursor advance location direction count means to update the old data, and 4 record the configuration of three-dimension cursor, or The cursor configuration location record means which carries out updating record of the data from the cursor advance location direction count means, Instruction distinction and an executive operation means for 5 to distinguish the instruction of the object-choice directions from an operator, object-choice discharge directions, etc. with relation with an input unit control means, and to perform a suitable processing means, 6 based on the data from configuration location record means 13, 16, and 19 of each object by which the location data of the cursor configuration location record means 4 or each set elephant configuration are recorded by the demand from the cursor advance location direction count means 3 The number according to each set elephant well informed person which performs contact count with three-dimension cursor and each object, and contacts three-dimension cursor, Furthermore, the contact part identification number which shows exact contact parts, such as a ridgeline in this object configuration and top-most vertices, is extracted. The object selected position computation means sent to a selection condition object record means with the spatial position data of the three-dimension cursor at the time of contact, A selection condition object record means by which 7 records the spatial position data of the actuation condition and selection object identification number of an object with three-dimension cursor, a contact part identification number, or the three-dimension cursor at the time of contact based on the data from the object selected position computation means 6, 8 distinguishes the actuation condition of an object with three-dimension cursor based on the data from the selection condition object record means 7 in response to the object-choice demand from instruction distinction and the executive operation means 5, or an object-choice discharge demand. The control means for actuation which controls the processing which follows this actuation condition, and moves and arranges the candidate for contact while recording that result on the selection condition object record means 7, and the processing which changes the attribute of an object, 9 by the demand from the control means 8 for actuation based on the data from the cursor configuration location record means 4 or the configuration location record means 13, 16, and 19 of each object An object preferential segregation processing means to perform processing which is made to move a selection object all over a three-dimension virtual space, or separates and arranges the object under three-dimension cursor and selection, 10 refers to the attribute changing condition currently recorded on the attribute deformation processing condition record means 101 by the demand from the

control means for actuation based on the data from the selection condition object record means 7 and the cursor configuration location record means 4. An attribute modification processing means for actuation to start the expression control means 11, 14, and 17 which create the data for changing the attribute of an object and actually change the attribute and configuration according to each set elephant, An attribute deformation processing condition record means by which, as for 101, the constraint of the modification tolerance of the attribute, the location, a direction which can change a configuration, etc., etc. is recorded according to each set elephant from relation with the attribute modification processing means 10 for actuation, A cursor display-control means to control migration and a display of the three-dimension cursor with which 102 is restrained by the deformation direction and location of the configuration at the time of the target attribute modification with relation with the attribute modification processing means 10 for actuation, The contents of deformation of the configuration which 11 updated the configuration data of the target body with relation with the attribute modification processing means 10 for actuation, and was changed if needed are followed. Change objective attribute value data or The body expression control means which transmits data required in order to draw a body to the display generation means 20, A body attribute record means by which 12 carries out updating record of the attribute value, such as a color of each body, and a feeling of the quality of the material, with relation with the body expression control means 11, A body configuration location record means by which 13 carries out updating record of objective configuration data and spatial position data with the relation between the object selected position computation means 6, the object preferential segregation processing means 9, or the body expression control means 11, The contents of deformation of the configuration which 14 updated the configuration data of a view function with relation with the attribute modification processing means 10 for actuation, and was changed if needed are followed. Change the attribute value of a view function or The view function table present control means which transmits information, such as configuration data of a view function, and attribute value, to the display generation means 20, A view functional attribute record means by which 15 carries out updating record of the attribute value of whenever [angle-of-visibility], a visual field field, etc. with relation with the view function table present control means 14, The view functional configuration location record means which carries out updating record of the configuration data as which 16 expresses a view function with the relation between the object selected position computation means 6, the object preferential segregation processing means 9, or the view function table present control means 14, or the spatial position data, The contents of deformation of the configuration which 17 updated the configuration data of a light source function with relation with the attribute modification processing means 10 for actuation, and was changed if needed are followed. Change the attribute value of a light source function, or The light source function table present control means which transmits information, such as configuration data of a light source function, and attribute value, to the display generation means 20, A light source functional attribute record means by which 18 records attribute value, such as the self-luminous color and light source reinforcement, with relation with the light source function table present control means 17, A light source functional configuration location record means to record the configuration data as which 19 expresses a light source function with the relation between the object selected position computation means 6, the object preferential segregation processing means 9, or the light source function table present control means 17, and spatial position data, 20 is a display generation means to draw to a display all the objects that performed view count and light source count based on the data from the body expression control means 8, the view function table present control means 12, the light source function table present control means 16, and the cursor display-control means 4, and include three-dimension cursor. Next, the actuation during each configuration is described. An operator does selection migration of the object with a three-dimension location and direction data required in order to move three-dimension cursor by operating input devices, such as the three-dimension location direction input device and a keyboard, and three-dimension cursor, or inputs the directions separated and arranged. The input-device control means 1 reads in an input device the three-dimension location and direction data which the operator inputted, and various directions information, and a three-dimension location and direction data are passed to a three-dimension system-of-coordinates location and the direction modification means 2, and it passes

directions information to instruction distinction and the executive operation means 5.
[0031] With a three-dimension system-of-coordinates location and the direction modification means 2, the three-dimension location and direction data from the three-dimension location direction input device are changed into the logical three-dimension virtual space coordinate value currently dealt with by the system of this example. With the cursor advance location direction count means 3, while calculating the spatial position of new three-dimension cursor based on the location and direction data changed with the three-dimension system-of-coordinates location and the direction modification means 2, the location data of the three-dimension cursor currently recorded by the cursor configuration location record means 4 are updated. The cursor advance location direction count means 3 starts the object selected position computation means 6 next. With the object selected position computation means 6, the configuration location data of all the objects in [the configuration location record means 13, 16 and 19 of each object to] a three-dimension virtual space are read for the present spatial position data of three-dimension cursor from the cursor configuration location record means 4, and contact count with three-dimension cursor and all objects is performed. The spatial position data of the existence of contact, a contact object identification number, the part identification number for contact that showed the contact part of a still more exact three-dimension cursor and object, and the three-dimension cursor at the time of contact are recorded on the selection condition object record means 7 as a result of this count. The three-dimension cursor location data at the time of this contact are used when calculating deformation from the movement magnitude of cursor, in case the configuration of an object is made to deform and that attribute is changed.
[0032] In the control means 8 for actuation, if the selection directions with the three-dimension cursor from instruction distinction and the executive operation means 5 and an object and selection discharge directions are received, the actuation condition of an object with decision and the three-dimension cursor of the existence of a contact object will be judged based on the information from the selection condition object record means 7, and this information will be recorded on it at the selection condition object record means 7. Furthermore, a selection demand or a selection discharge demand is published with an object identification number based on this information to an object preferential segregation processing means 9 to perform processing which moves and arranges an object, or an attribute modification processing means 10 for actuation to perform processing which changes the attribute of an object from that configuration is started.
[0033] With the object preferential segregation processing means 9, the demand and assignment object identification number data which are outputted from the control means 8 for actuation are followed. In order to move the assignment object holding the physical relationship of three-dimension cursor and an assignment object or to separate and arrange three-dimension cursor and an assignment object The configuration location data of the object specified in the location data of three-dimension cursor out of each configuration location record means 13, 16, or 19 are read from the cursor configuration location record means 4, and after performing three-dimension geometry count, the configuration location data of an assignment object are updated.
[0034] With the attribute modification processing means 10 for actuation, the attribute change request from the control means 8 for actuation starts. The contact object identification number and contact part identification number which are recorded on the selection object record means 7, and the three-dimension cursor spatial position data at the time of contact, Furthermore, deformation movement magnitude and the direction of [for making the configuration which visualized the attribute value of each object deform based on the tolerance and the constraint of attribute modification which are recorded on the attribute deformation art record means 101] are calculated, each expression processing means 11, 14, and 17 are started, and the attribute configuration of an object is made to change. It can come, simultaneously the cursor display-control means 102 is made to control delivery, and the motion and display of three-dimension cursor at the time of attribute modification for the deformation movement magnitude and direction data for which it calculated and asked. a base [amount / by the difference of the three-dimension cursor-location data at the time of the object contact to which the deformation movement magnitude and the direction of the attribute configuration searched for by this

count is recorded on the selection condition object record means 7, and the location data of three-dimension cursor which read from a cursor configuration location record means 4 after attribute modification actuation assignment decision / relative] -- carrying out -- the tolerance and the constraint data of attribute modification -- since -- it is asked.

[0035] In the body expression control means 11, by the demand from the expression attribute modification processing means 10 for actuation, the body configuration data in the body configuration location record means 13 are updated, and the attribute value of the assignment body in the body attribute record means 12 is updated according to these contents of configuration modification. Moreover, by the demand from the display generation means 20, configuration data required in order to display each body, location data, and attribute data are read from a body configuration and the location record means 13, or a body configuration and a location record means 12, and the display generation means 20 is passed.

[0036] In the view function table present control means 14, by the demand from the expression attribute modification processing means 10 for actuation, the configuration data of the view function in the view functional configuration location record means 16 are updated, and the attribute value in the view functional attribute record means 15 is updated according to the contents of updating of this configuration. Moreover, the view functional attribute data from the view functional attribute record means 15 required in order to perform a display and view computation of a view functional configuration, and the configuration location data from the view functional configuration location record means 16 are passed to the display generation means 20 by the demand from the display generation means 20.

[0037] In the light source function table present control means 17, by the demand from the expression attribute modification processing means 10 for actuation, the configuration data of the light source function in the light source functional configuration location record means 13 are updated, and the attribute of the assignment light source kind in the light source functional attribute record means 18 is updated according to the contents of updating of this configuration. Moreover, the light source functional attribute data from the light source functional attribute record means 18 required in order to perform a display and light source computation of a light source functional configuration, and the configuration location data from the light source functional configuration location record means 19 are passed to the display generation means 20 by the demand from the display generation means 20.

[0038] With the display generation means 20, view count and light source computation are performed based on the various data from the cursor expression control means 102, the body expression control means 11, the view function table present control means 14, and the light source function table present control means 17, and all objects including three-dimension cursor are drawn to a display.

[0039] while the space direct-control system of a view and a light source function can show an operator the attribute of a view function or a light source function in a three-dimension configuration visually above according to this example, the arbitration part of a view or the configuration of a light source function is refer to as choose directly and move in a virtual space like actuation of a body -- it is easy and the actuation which carried out 1 practice, and, moreover, the object of arbitration can choose without the change assignment for actuation at any time. Moreover, each functional effect corresponding to space actuation of a view functional configuration or a light source functional configuration also becomes possible [displaying on real time]. Furthermore, the attribute value can be changed by inputting neither a numeric value nor a notation from a menu etc., but deforming directly the configuration which visualized the attribute of a view function or a light source function in a three-dimension virtual space. By these functions, compared with the three-dimension information processing system which supported actuation of the conventional view function or a light source function, an operator can grasp now intuitively the contents of an attribute of a view function all over a three-dimension virtual space, or a light source function, and the space position relation between a function and an object, and can operate each function now easily and quickly in the location and the direction which he means. Moreover, since an operator can change attribute value visually by deforming soon the configuration which the attribute visualized, without changing attribute value with the numeric value

and notation which cannot predict an attribute modification result easily, attribute modification of an intuitive and easy function of him is attained.

[Translation done.]